Instruments

THE MAGAZINE of MEASUREMENT and CONTROL

Vol. 23 AUGUST 1950 No. 8

INCLUDING THE *Journal of the Instrument Society of America*

AND THE *Journal of the Southern California Meter Association*

"INSTRUMENT BANK" in the world's largest research laboratory devoted to the development of safety equipment

Story on page 856

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You KNOW with the new

WESTON photoelectric light recorder

Rain or shine, fusees must burn—*bright*. Light output, in fact, must conform to rigid specifications. But how to measure it? Sputtering fusees drive conventional light meters all over the scale . . . make accurate readings impossible.

It was to measure—and record—such transient light values that the Weston Photoelectric Light Recorder was developed. This new instrument charts illumination values of various colors as the eye perceives them—thanks to its *Viscor correction filter. Its *Photronic photoelectric cell is of the dry disc type made by Weston for over fifteen years. And its *Celectray recorder, of proved TAG design, follows the sputtering without overshooting or hunting. Full scale values of 20, 40 or 80 foot-candles are selected with a simple switch.

If you need to measure and record—accurately—fast fluctuations in illumination, investigate the Weston Photoelectric Light Recorder.

*Registered Trade Mark

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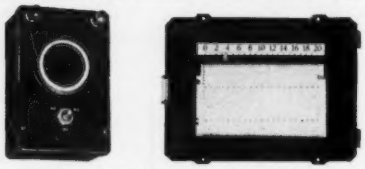
MEASURES illumination accurately over a 0-20, 0-40 or 0-80 foot-candle range.

DUPLICATES the color response of the average human eye.

RECORDS changes in illumination continuously, following rapid fluctuations accurately.



Compact photoelectric cell assembly, left, can be located wherever convenient. The recorder, right, is designed for wall mounting.

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Manufacturers of Tagliabue and Weston Instruments

591 Frelinghuysen Avenue, Newark 5, N. J.

TAG

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24 HOUR MIDGET DRIVE

The 24-hour Rockwell Midget is 24-hour rotation only, with a 48-hour rundown. The 8-day drive is basically 24-hour rotation. Turrets are available to give ten alternate rotation speeds ranging from 2-hour to 8-day.

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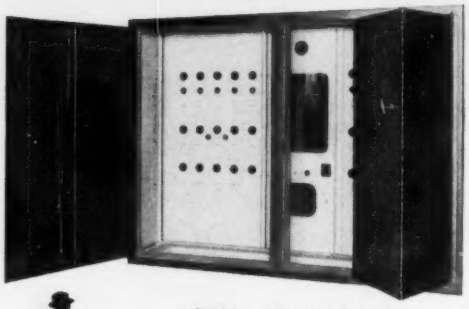

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Instruments

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Instruments THE MAGAZINE OF Measurement and Control

M. F. BEHAR, Editor

Make Plans for Your Trip to Buffalo

IT IS a pleasure to devote this page, for the fifth year in succession, to announcing the National Instrument Conference and Exhibit and urging all our readers to attend.

The ten or fifteen percent of our readers who are members of the Instrument Society of America need no special urging: by the time this issue gets mailed, they will have received the ISA's own publicity material.

To the majority—the non-members—we suggest that they read the Technical Program on pages 788-789 and the descriptions of the exhibits on pages 790-796.

Five societies, in addition to the ISA itself, will hold technical sessions. From the titles of the papers and the names of the authors, one gains the impression that many important disclosures will be made. These disclosures will include the removal of wraps from material previously "classified" by military authorities. Apart from such disclosures, there will be the wealth of highly-informative "practical papers" for which ISA meetings are becoming famous.

In this connection, it seems to us that the co-sponsor societies are making it a point to schedule "practical" papers for their joint meetings with the ISA—and we believe that their Program Chairmen deserve congratulations and thanks for this policy. The ISA is not a "professional society" with membership restricted to graduate engineers, scientists, etc. At the meetings of most ISA sections throughout this country (and Canada and the West Indies) eager young mechanics rub elbows with professors, chemists, physicists, mathematicians, professional engineers and other men of long experience. Sometimes a young "gadgeteer" gives a practical talk on the subject that he has mastered—and is thanked by the engineers and scientists for teaching them new methods not found in text-books or professional journals.

This is one of the glorious and inspiring aspects of Instrumentation—for Instrumentation is a mixture of exact science and practical know-how. And its devotees are all brothers, regardless of their particular occupations. As was printed on this page in 1933 and many times since then:

"All men, who conceive, invent, design, develop, build, sell, specify, apply, install, service and maintain measuring instruments, meters, gages, testers, counters, totalizers, automatic inspection devices, automatic controllers and all their related devices and accessories are brothers . . . making better things for more people, eliminating repetitive drudgery and making our world a better one."

Of course, most of the disclosures to be made at Buffalo next month will eventually find their way in print. But

nothing can take the place of personal attendance. There is no adequate substitute for participating in discussions and "bull sessions." There is no satisfactory substitute for seeing and handling the instruments on display and talking with the instrument-company representatives in attendance.

From a glance over pages 790 to 796, you will note that most exhibitors are featuring NEW instruments and instrumentation products. The ISA officials inform us that the proportion of new products, and their total number, will both be greater than at the four previous expositions. This is not astonishing: the number of items in "The Month's New Instruments" has been mounting and mounting. Again it sets a new record, with 141 items in this issue—twice the monthly averages of recent years.

Although specific results of this conference cannot be foretold, the predictions made on this page four years ago and two years ago may be repeated—predictions of greater importance of the functions assigned to (A) instruments and (B) Instrument Men.

(A)

The increasingly-important functions assigned to measuring and automatic-control instruments will be:

1. Minimizing the sum total of human drudgery, especially in eliminating repetitive operations and particularly in automatic dimensional gaging, automatic inspection of products, automatic grading, automatic computation, etc.;

2. Creating new and better kinds of jobs;

3. Better working conditions;

4. Labor saving in the sense of increasing productivity bringing about higher wages and lower prices;

5. Fuel saving and electric-energy saving in utilization;

6. Materials saving;

7. Prolonging the service-life of processing equipment;

8. Increasing production from processing equipment;

9. Accelerated modification of processing equipment, even to scrapping present equipment in acceptance of the oft-repeated preachment "Design controllability into production units!";

10. Better quality and uniformity of product;

11. Minimization (sometimes elimination) of rejects;

12. Minimizing reliance on human watchfulness;

13. Accident prevention;

14. Accelerating the conversion of batch processes to continuous processes;

15. Closer control in both senses: (a) product control and (b) automatic control;

16. Improvements in services rendered to the public by ALL of the transportation and communications industries;

17. Better weapons and warning systems for the preservation of our Nation and the prevention of a world war.

18. Continued improvements in meteorology, navigation, geophysical sciences, biological sciences, preventive and curative medical practices, actuarial science and other computational occupations . . . and numerous other non-industrial fields depending increasingly on instruments;

19. Creating new industries and rehabilitating and expanding old industries.

(B)

There will likewise be an enhancement of the functions assigned to the Instrument Man, be his title "mechanic" or "President." The enhanced importance of these functions will be accompanied by:

1. Enhanced status—increased recognition by others and increased pride in one's own job regardless of title.

2. Greater stability of employment—less dependence on "politics" or on the fortunes of wars between factions.

3. Relatively higher percentual raises in pay.

4. Closer association of Instrument Men with one another through formation of new ISA Local Sections.

5. Closer association of instrument-minded engineers, technicians, scientists, executives, educators, etc., with one another through greater official interest in Measurement and Control within other existing societies.

6. An increase in instrument education—first a QUANTITATIVE increased enrollment in courses on Instrumentation subjects.

7. A corresponding—but not measurable—QUALITATIVE improvement in instrument education.

—MFB

REPORT ON WESTERN EUROPE

Second Article--My Visits to Industrial Fairs-- [Continued]

By RICHARD RIMBACH, Publisher of *Instruments*

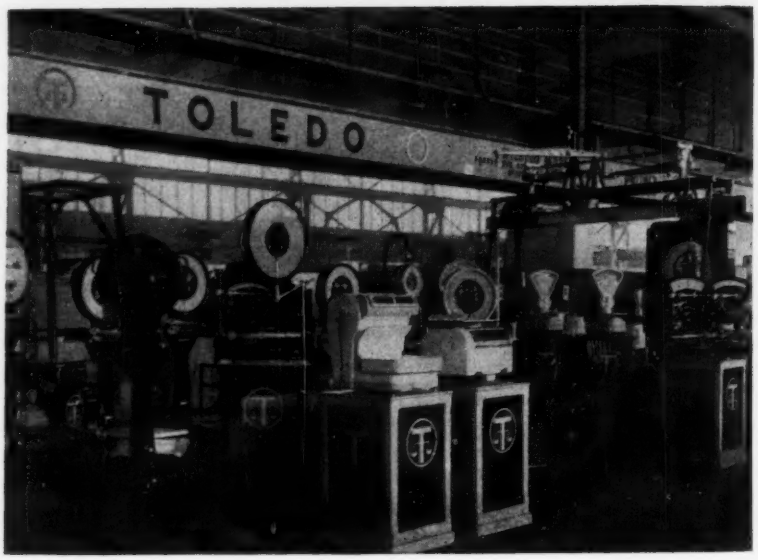
I THEN travelled to Zurich, Stuttgart, Frankfurt, Duesseldorf and Hamburg visiting instrument manufacturers and a few research laboratories, arriving in Hanover on May 3rd for the Hanover Fair. This Fair is an International Fair and products shown are not all manufactured in Germany. The displays were not as elaborate as those in Switzerland, probably because companies must operate on a much smaller budget.

The Hanover Fair published a 744-page catalogue which has an alphabetical list of companies, their addresses and a brief product listing and booth number of location in German. The product listings index with page references to the product listings are printed in separate lists in German, English and French. The product listings give under each listing the exhibitor's name, address, and booth number and location. Advertising is also included.

This is the fourth Hanover Heavy Industries Fair. (Actually the Hanover Fairs are two in number, the Light Industries Fair which is held about a month earlier and is primarily for consumer goods.) At the Heavy Industries Fair there were about 2000 exhibitors with a total of over one million square feet of exhibit area of which about 800,000 sq. ft. were under roof.

Owing to the fact that the Germans lost their patent rights at the end of the war, they were hesitant to display new products and furnish data on new developments. It is expected that the Allied High Commission will restore some semblance of patent rights this year. At Hanover there were a few new developments which came to my attention:

THE HANOVER FAIR
May 3-14, 1950



Deutsche Gold-und Silber-Scheideanstalt demonstrated a new electric resistance thermometer for very small temperature fluctuations from minus 200 deg. to plus 550 deg. C. The instruments are arranged for connection to 110/220 volts, 50 cycles.

E. Leitz GmbH, showed a number of new developments: (1) One of these was a dividing head for the manufacture and checking of gears, camshafts and dimensions of parts by optical means, which makes the accuracy independent of the moving parts and wear. (2) A midget harness tester (Durimet) for determining the hardness of very small parts, then layers and foils. The load range is from 25 to 300 grams. The indentations are measured with an accuracy of 0.0005 mm. (3) The Perflectometer is an instrument for measuring outside diameters, conical bores, etc. No pressure is used, but the surface is viewed optically. It is claimed that the Perflectometer has the advantage that not only the upper edge of the part is measured but it is possible to measure dimensions at any desired point, thus permitting the optical measurement of concave surfaces, i.e. ball bearing races. Accuracy 0.3 micron.

H. Maihak A. G. exhibited a remote indicating extensometer for measuring elongation, reduction of area, tension, compression, etc. The instrument is based on the principle that the frequency of vibration of an object is proportional to the stress in the object, i.e. the frequency varies as the square of the stress.

The "test-wire" is made up of a stretched wire with an electromagnet to make it vibrate. The test-wire is attached to the structure under test. Any number of similar test wires can be used. Only one receiving instrument is necessary. By pressing a key on the receiving instrument an electrical impulse is transmitted to the electromagnet which causes the stretched wire to vibrate in its own natural frequency. A standard wire, in the receiving in-

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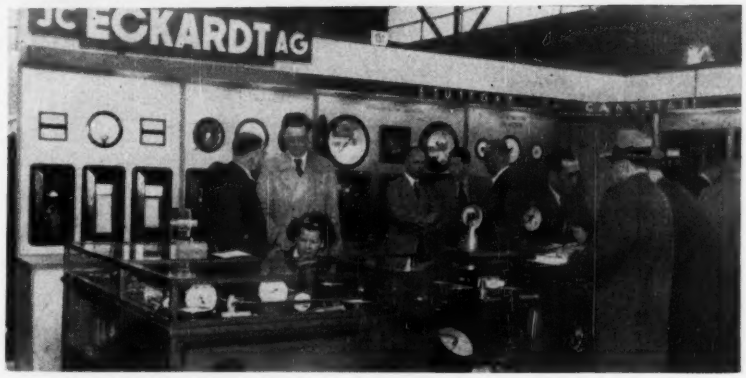
strument, is vibrated by depressing another key in the instrument. By rotating the dial-scale the frequency of the test-wire and the standard wire can be synchronised. The resulting reading on the dial-scale multiplied by the calibration constant gives the stress in numbers.

Siemens and Halske A.G. had a new astatic electric instrument for the measurement of current, voltage, wattage and power factor. In this instrument a light beam is deflected by a mirror fastened to the moving system and the light spot is projected on to the scale.

Returned to London for the opening of the British Industries Fair on May 8th. The displays are limited to the products of the United Kingdom and the British Commonwealth. The first fair was held in London in 1915. The 1950 Fair had 1781 exhibitors occupying about 500,000 sq. ft. in London and 1257 exhibitors with about 480,000 sq. ft. in Birmingham. The rail trip from London to Birmingham takes about 3 hours. In London the exhibits largely comprise consumer goods, but the scientific instruments were on display here. At Birmingham, the heavy equipment and raw-materials were shown and the manufacturers of industrial instruments displayed here.

The British Industries Fair publishes a three volume catalogue: Volume I covers the Earls Court and Olympia exhibition (London) and has 900 pages and contains an alphabetical list of exhibits, a classified list of exhibitors, and advertisements of exhibitors and



The writer was standing at the right (hat and overcoat) when this photo was taken.

BRITISH INDUSTRIES FAIR
(1) The London Exposition, May 8-19

BRITISH INDUSTRIES FAIR (*cont'd*)

non-exhibitors. Volume II (170 pages) is a products index of products of the above exhibition with page references to Volume I in French, German, Spanish, Italian, Danish, Swedish and Norweigian.

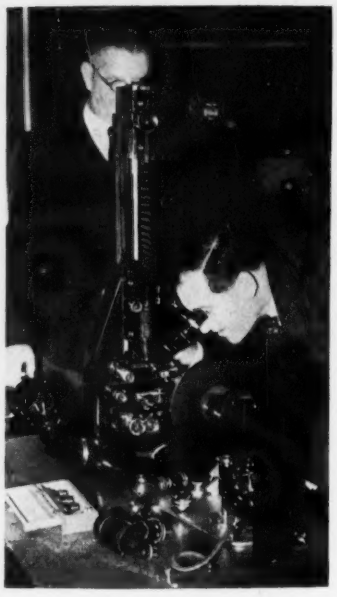
Volume III (890 pages) covers the Birmingham exhibition and has alphabetical lists of exhibits in the above foreign languages, an alphabetical list of exhibitors, address, exhibit details, booth number and location; an alphabetical list of exhibitors, address, exhibit details, booth number and location; an alphabetical index of products with page references; and a classified list of exhibits with company names and booth numbers. Advertising is also included.

The Scientific Instrument Manufacturers' Association organized a composite area of which the center feature was a display of the British Ministry of Supply on atomic energy. A working model of one of the atomic piles at Harwell was shown.

It will be appreciated that it is rather difficult to report all of the new developments exhibited in a fair owing to the lack of time available to visit all of the booths. A few of the developments which I noted were the following:

Baird & Tatlock, Ltd. had a self-balancing photoelectric recording absorptiometer, developed by the Norwich Works, Imperial Chemical Industries, Ltd., Instrument Department, which was designed to record small color changes in liquids. With color filters the instrument can record the composition of a liquid whose absorption can be related to some form of a chemical analysis or turbidy.

C. Baker (of Holborn) Ltd. exhibited a new model of stereoscopic binocular



Labor Minister Isaacs peers through a microscope at the B.I.F.

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microscope as well as a number of student and research microscopes.

W. & J. George & Becker, Ltd. had a new aperiodic balance of 200-gm. capacity, sensitive to 0.1 mg. Weights up to 100 gm. are applied automatically by means of a weight change mechanism.

Cinema Television, Ltd. exhibited metal detectors for detecting buried pipes and cables, as well as for detecting minute pieces of metal in foodstuffs and other materials.

Dawe Instruments, Ltd. showed a stroboscopic light, automatically locked to the movement of a weaving machine under study, so that the shuttle may be studied stationary at any position in the weft. This device permits measurement of speed and locating weaving faults due to shuttle defects.

Another new instrument was an electronic moisture measuring device for textiles, which permits the measurement and control of the moisture of textiles by controlling the speed of the drying machine.

Industrial Diamond Information Bureau exhibited the following new instruments: a drum abrasion tester; a micro-macro-hardness tester and a micro-abrasion tester.

Everett, Edgcumbe & Company, Ltd. showed a wide range of portable and switchboard electrical instruments including a railway speed recorder and an insulation tester.

The British Industries Fair At Birmingham

The industrial instrument and control manufacturers had their exhibits at Birmingham and among these the following new products were shown:

Accles & Pollock, Ltd. showed samples of small diameter precision tubing including Bourdon and capillary tubing, including stainless steel.

Elliott Bros. Ltd. demonstrated automatic control of a four-zone furnace by magnetic amplifiers; and a high-speed radiation pyrometer. The products of Fisher Governor Company were also shown in this booth.

Ether, Ltd. exhibited a high-speed dial indicator using a photocell electronic amplifier to amplify small thermocouple voltage. The same amplifier used in conjunction with a radiation pyrometer permits the measurement of low temperatures by radiation methods at high speeds. The exhibitor also exhibited products of the American Companies: Wheelco Instrument Company and Claud S. Gordon Company.

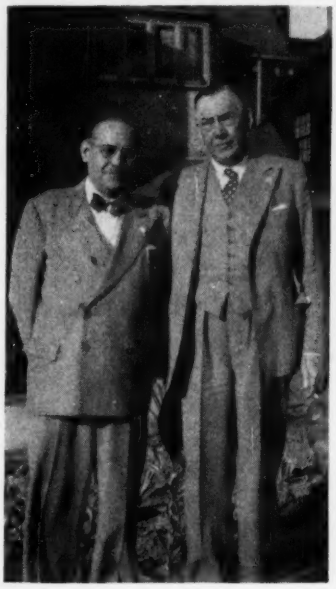
Electro Methods, Ltd. exhibited various temperature control devices, electromagnetic relays; magnetic amplifiers; electronic timers; and a special low-inertia low-power motor, which has a linear voltage-speed curve and is ideal for use with servomechanisms.

Negretti & Zambra Ltd. showed a new fuel flow meter for aircraft use. The principle of operation depends on an orifice measurement where the area of discharge is controlled in such a way as to maintain a constant pressure difference across the orifice.

The Paris Fair

After visiting the London and Birmingham plants of the British Industries Fair, I left Birmingham for the Paris Fair on May 14th. The Paris Fair, the 39th, is truly international as 25 countries were represented among the better than 10,000 exhibitors who occupied over a million square feet. The fair is the outgrowth of a small group of exhibits of toys in 1904.

The catalogue of the Paris Fair printed in French had 1200 pages. It had an alphabetical list of exhibitors with their addresses, brief product list-



The writer (left) and Horace Stevenson of Ether, Ltd., standing in front of the latter's home.

The replica of the British atomic pile at the B.I.F.

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ings and booth locations; and an alphabetical product index with exhibitors names and booth locations. Advertising of exhibitors as well as non-exhibitors is included.

Among the instrument exhibitors many showed foreign instruments as the representatives of foreign instrument manufacturers particularly American: Allen B. DuMont Laboratories, General Plate Division of Metals & Controls, Corp., General Radio Co., Magnaflux Corp., Shore Instrument & Mfg. Co., Sprague Electric Co., Stevens-Arnold, Inc., and Weston Electrical Instrument Corp.

Left Paris for the States on May 16th at 9 P. M. arriving in New York on May 17th at 7 A.M., an actual flight time of 15 hours.

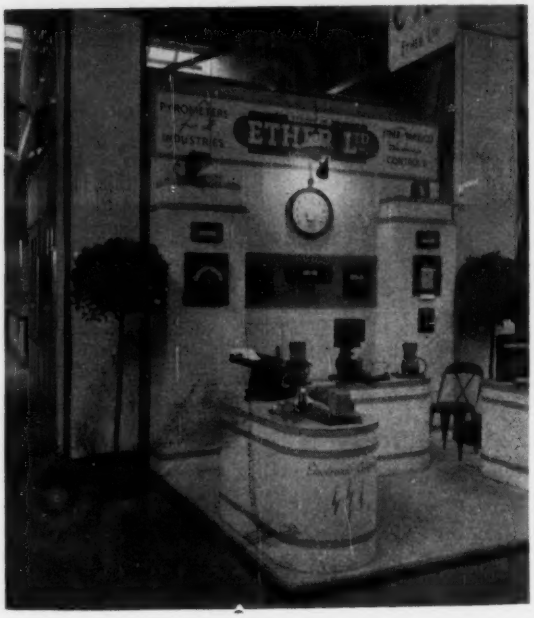
Editor's Note. This is the second of three articles by Mr. Rimbach. The third, giving his conclusions and predictions, will appear in our September issue.

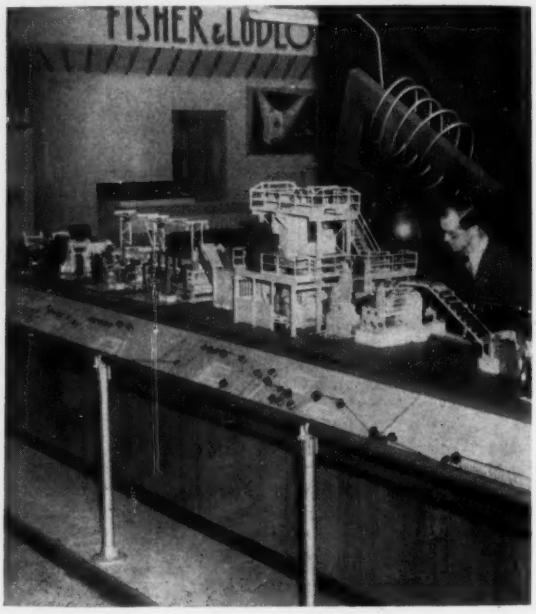
Paris Trade Fair

May 13-29, 1950

BRITISH INDUSTRIES FAIR

(2) The Birmingham Exposition, May 8-19, 1950





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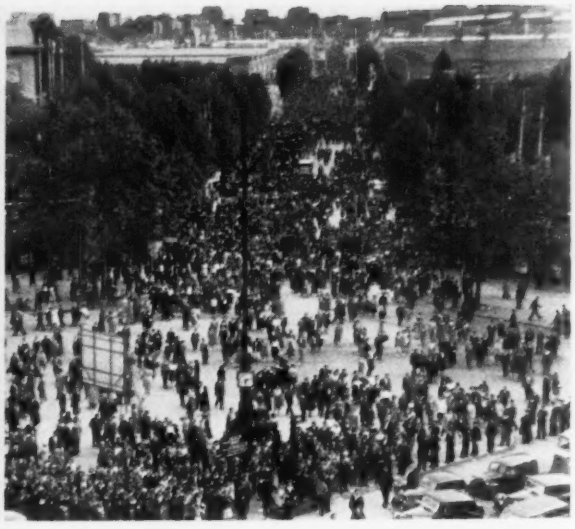

PROMESUR
SMITH-HARTMANN

NOTES ON CONTROL VALVES

By R. B. WEREY*

AUTOMATIC-CONTROL literature embraces many fine dissertations on the importance of the control valve as a component part of the control system; this literature has been supplemented with talks and lectures before interested groups by a host of speakers whose primary purpose has been to impress the listener with the fact that the control valve is as important as the primary instrument in any control system.

There can be little doubt that this effort has been well expended and that, as a whole, the expositions have been expertly made. But a study of these works reveals that a major portion of them have been devoted to the controversial and nebulous subject of "proper inner-valve characteristics" or to theoretical subjects directly related to the effect of plug characteristics on the remainder of the control system.

Little has been said of the importance of sound basic body design, proper types of motor operators, manufacturing limitations and, most important of all, good manufacturing standards. Where such points have been stressed, the reader or listener has often been quite unimpressed, primarily because the author failed to illustrate his points with specific examples or because he assumed that the average user was able to spot weaknesses on sight.

There is much evidence to prove that this is far from true.

Characterized Inner Valves

Without any thought of influencing opinion or passing judgment on the subject, it is felt that every thoughtful reader should approach the subject of "characterized inner-valves" with an analytical and scrutinizing eye. Not that all preachments of the past are questionable, but for one to assume, for example, that "equal percentage characterization" is the panacea for all control-system ills is quite naive and indicative of unfamiliarity with the many other factors entering into the problem of automatic control. Some technicians† question the use of "equal percentage" inner-valves under any except a few specific conditions; they point out that a simple, linear-characteristic, bevel-seated inner valve is quite sufficient for a major portion of all control services. Control engineers will concede that many of the points brought out are indeed well taken, even if they do not agree entirely with all of the conclusions. The important thing to bear in mind about highly-characterized inner valves is that while they may be proved valuable in certain theoretical analyses, the attainment of such theoretical conditions in actual commercial practice is difficult—in many instances impossible. The answer to the controversy about "characterization" probably lies in some middle-ground which recognizes and concedes that a plug with an exponential type of flow curve makes a safer and more versatile valve for general all-around use.

Regardless of the reader's point of view on this subject, he should not become so hypnotized with theories that he fails to put proper weight on the previously mentioned subjects of sound basic body design, proper types of operators and quality manufacturing. The purpose of this article is to point out a few of the misconceptions prevailing on the subject of control-valve capacity, valve-body pressure losses, a spring-and-diaphragm motor's ability to position the valve plug and the importance of manufacturing skill and know-how.

"Any attempt to improve [diaphragm-motor] operating force by merely enlarging diaphragm area is illogical and unsatisfactory. The answer lies in the use of a valve positioner and a complete re-appraisement of motor design."

Valve Body Design

In a recent article, Werey and Eckman* point out (among other things) that improper valve body design can affect control valve capacities and plug characteristics at high pressure differentials. The article indicates that the nomographs used for determining valve capacities take no cognizance of the possible reduction in full open capacities (C_V factor) nor the change in plug characteristics when the valve is used under high pressure differentials. In other words, such nomographs assume that the inner valve has the same "K" factor (equivalent to orifice efficiency) and provides the same characteristic curve whether the pressure differential across the valve is 1 psi. or 1,000 psi. It was shown that this was an erroneous assumption and that the only way to maintain constant characteristics in a given valve body is to either (a) tailor the inner valve port area to fit the differential in conventional globe valve bodies or (b) use a streamlined body of such design that there can be no cavitational effects or eddy currents at the entrance and exit ports.

A corrollary to this statement is that it is impossible to combine simultaneously in a *conventional* globe valve body the features of maximum capacity and good inner-valve characteristics under a variety of pressure differentials. For maximum capacity, one must make the inner valve port area large, use the valve only on low pressure differentials and forget about characteristics because of the probable absorption of the differential by line losses. If one desires a control valve which will maintain its characteristics over a wide range of pressure differentials, he must content himself with smaller inner valve port areas and, therefore, correspondingly smaller capacities. It must be borne in mind that the main inlet and exit ports of any valve cannot have areas greater than those corresponding to the nominal pipe size of the particular valve. To market control valves having allegedly good flow characteristics over wide pressure differentials with inner valve port areas equal to the valve inlet and exit ports is proof of unfamiliarity with the main concept of a control valve.

Most reputable manufacturers are conversant with these important points and make no attempt to sell their products on capacity factors alone. Trade practices vary to some degree but, for the most part, port areas of recognized manufacturers average around 40 to 60 percent of corresponding standard pipe area (inside area). The wise buyer is also conversant with these factors, and does not penalize a manufacturer for recommending valves with reduced port areas (and less capacity) when such valves are for use on high pressure differential service.

The article indicates that restricted inlet and exit ports, tortuous convolutions in body design, and valve plugs with poor "K" factors can seriously reduce maximum valve capacities (C_V factor), even when used under moderate differentials. It was shown that frictional resistance due to these factors increased, not as the square of the fluid velocity as commonly thought, but possibly as high as *the sixth power of the velocity*. It is therefore evident that these nomographs can be considerably in error unless bodies are carefully designed in the first place and valve plugs with high "K" factors are used.

Much of the criticism leveled at the characteristic curve of bevel-seated disks originates from lack of appreciation that these unsatisfactory curves are due more to the use of incorrect ratios between inner-valve port areas and nominal body areas than to the specific design of the plug itself. It has always been customary to make

†Conoflow Corp., Philadelphia.

‡Ziegler and Nichols, "Valve Characteristics and Process Control," *Instruments*, January 1949

*"Control Valve Body Design," *Instruments*, March 1949, pages 269-273.

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the port areas of bevel-seated disks at least equal to the nominal area of the corresponding pipe size, much on the theory applied to conventional hand globe valves, namely that the ports should be as big as possible to avoid pressure loss in the valve. As every good control engineer knows, the theory of pressure drop in control valves is diametrically opposite to the same theory when applied to conventional hand valves. In a control valve, one *must* have a pressure differential in order to make the valve operative; whereas in hand valves it is desirable to keep the pressure loss as low as possible.

The sharp tail on the characteristic flow curve of conventional bevel-disk control valves can be eliminated if the inner valve port area is reduced to about 40 percent of the nominal valve size pipe area. The valve will then tend to approach true linear characteristics throughout the entire stroke instead of suddenly dropping off in capacity after it has passed the halfway mark.

Stuffing Box Friction

In analyzing the merits of a given control valve characteristic, whether it be "equal percentage", "parabolic", "linear" or any one of a dozen other types, one takes as an accepted fact the graphic representation of a given flow for a given valve position. Although the discerning engineer appreciates that such curves only apply when pressure differentials across the control valve are constant and that such conditions rarely prevail, nevertheless he often fails to question the mechanics of how to obtain a new valve stem position for every small increment of pressure change from the primary instrument. Much stress is laid on the sensitiveness and responsiveness of the primary instrument and its ability to change the output pressure within tenths of an inch of water for correspondingly small load changes; but obviously such sensitiveness is entirely wasted unless the response curve of the control valve is equal to or better than that of the control instrument.

One cannot dismiss this emphasis on extreme sensitiveness by implying that only a few control services require such accuracy; the fact of the matter is that expert control engineers find few instances where they can positively assert that the responsiveness of the control valve need not match that of the instrument.

What are the factors which determine a valve's sensitivity? Is it wholly the motor operator or is it a combination of operator and valve body construction?

There is little doubt that some engineers have failed to analyze the true nature of a conventional spring-and-diaphragm motor as a power unit. Many still believe that large-area diaphragms and heavy-duty springs make a powerful operator and provide insurance that a valve stem will be accurately positioned, regardless of stuffing box friction and heavy internal unbalanced loads. Nothing could be further from the truth as a little careful analysis will disclose. But, before elaborating on this point, it might be well to study in more detail the exact nature of control-valve stuffing-box friction.

There is one fundamental difference between the assembly of a stem and plug in a hand valve and that in a control valve. In a control valve, the plug and stem are assembled as an integral unit so that the plug cannot spin on the stem; in hand valves, the plug is loose and free to position itself in any direction. It is obvious that the method used in hand valves makes it quite simple to obtain tight seating with little or no attention to close tolerances and need for absolute concentricity between the valve stem and the seat ring. If such manufacturing methods could be tolerated in control valves, the problems would be greatly simplified; but the danger from the plug spinning under high velocities and the sloppy fit which exists in this design prohibit any consideration of this method in high-grade control valves.

If the buyer will continue his scrutiny of manufacturing tolerances, he will find that high rangeability ratios are obtained by keeping clearance tolerances between plug and seat ring within thousandths of an inch. "Rangeability" is defined as the ratio between maximum controllable flow and the minimum controllable flow. Maximum flow is determined by body design, plug area ratios and the "*K*" factor previously discussed; minimum flow is determined, as stated, by the clearance between plug and seat ring. For example, in a one inch skirt-guided v-port valve, the nominal clearance between skirt diameter and internal seat ring diameter is about 0.002 in., which gives a minimum flow of 3 percent of maximum; if this clearance is increased to 0.010 in., minimum controllable flow is jumped to 10 percent and possibly as high as 12 percent of maximum. This, of course, reduces rangeability to as low as 8:1 or 10:1. When using ratio plugs, the problem is even more difficult. Therefore, it is evident that if we are to maintain high rangeability ratios, we must of necessity keep the plug and seat ring clearance small.

Fig. 1 shows a typical close-clearance control valve body assembly. It is evident that, with the above mentioned design limitations, the valve bonnet assembly must be bored and fitted absolutely concentric with the body and seat ring if we are to have a free-moving stem-and-plug assembly in the stuffing box. To accomplish this with nicety, it is also necessary to see that (a) the stem is inserted in the plug so that these two parts are absolutely concentric and (b) that the valve stem is absolutely perpendicular to the seating surface of the plug. In larger valves, using top and bottom guide bushings, the problem is accentuated because we now have two additional parts which must be in perfect alignment with the plug-and-seat-ring assembly. Only the most careful workmanship can eliminate these points as potential sources of frictional resistance.

What happens when manufacturing tolerances are sloppy? The answer is—excessive stuffing-box friction and leakage. Nor can this friction be reduced with special packing. It is there to stay or until it is removed by wearing of the affected parts.

It has been proved that a control valve made to close tolerances, with absolute concentricity between stem and seat ring, can be used under severe operating conditions with the simplest type of packing and without any signs of leakage. By the same token, a valve whose stem and plug guides are slightly out of alignment is difficult to maintain permanently tight regardless of the type of packing used.

Yet, regardless of how well the valve is made, there must always be present a certain amount of stuffing-box friction. The actual amount, measured in pounds of thrust required to reposition the valve, is a function of stem diameter, stem finish, depth of stuffing-box, workmanship as defined above, type of packing and a number of other factors specific to the type, size and operating pressure of the valve.

Although admittedly difficult to evaluate, this frictional force is nevertheless sufficiently great in the average valve to warrant consideration of its effects on accurate stem positioning. There has been entirely too much glossing over of this problem with claims of "friction-free" stems, "heavy-duty diaphragm motors" and other assorted features which do not stand up too well in the light of careful analysis. When used for throttling control service, the conventional spring-and-diaphragm motor, as previously stated, can hardly be classified as a power unit. Actually, it is merely a set of balanced forces whose potential power diminishes to practically zero as the width of the proportional band adjustment in the control instrument is increased. Any attempt to improve this potential operating force by merely enlarging diaphragm areas is illogical and unsatisfactory.

The answer to the problem lies in the use of a valve positioner and a complete re-appraisement of motor design. A good valve positioner has a multiplying ratio as high as 100:1, uses little air and requires a minimum of maintenance. One recent development in this field features a multiple-diaphragm type of positioner which can be built-in integral with the motor top (Fig. 2) thereby making it possible to eliminate the diaphragm-motor spring, increase the effective power and sensitivity of the diaphragm or piston and materially reduce the size and weight of the motor. There are no positioner levers to adjust and no external piping to install. These new motor assemblies provide stem positioning accuracies to within one part in 1,000 of total stem travel, irrespective

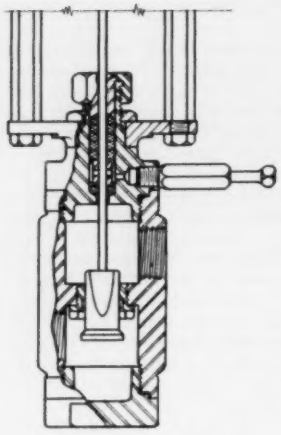

Fig. 1. Barstock body.

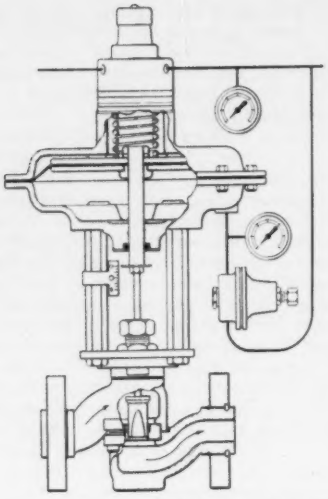

Fig. 2. Split-body valve with springless motor and built-in valve positioner.

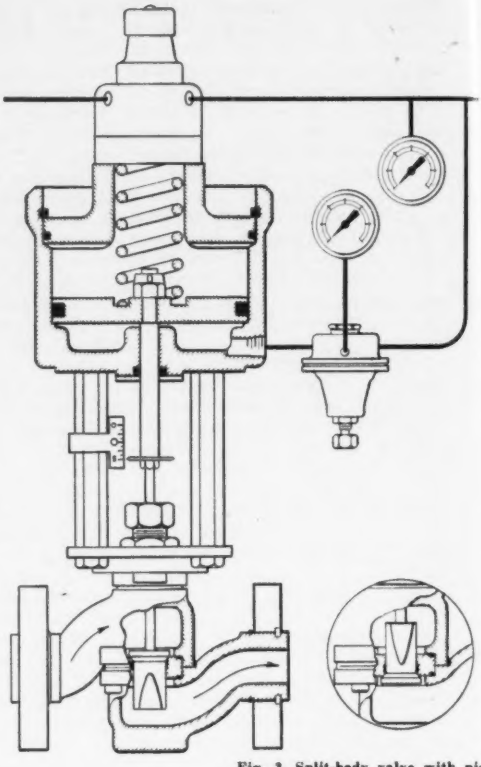

Fig. 3. Split-body valve with piston motor and built-in valve positioner.

of the magnitude of stuffing-box friction or the unbalanced load on the inner valve.

When combined frictional and unbalanced loads are large, the diaphragm type of operator is replaced with an aluminum alloy piston and cylinder combination (Fig. 3) using special "O"-ring seals and fitted with a built-in valve positioner capable of operating with supply pressures as high as 100 psi. instead of the conventional 20 psi. used on spring-and-diaphragm motors. Because of their power, sensitivity and inherent stability, these cylinder-type operators permit the use of single-seated valves instead of the unsatisfactory double-ported plug. The substitution of a single-seated plug in place of the double-ported plug is a tremendous step forward in itself and makes possible vast improvements in valve body design, flow characteristics, ease of seat ring replacement, greater resistance to erosion and general all-around efficiency. When the single-seated valve plug is incorporated in a truly streamlined valve body (Fig.4) it is possible to obtain highly satisfactory flow characteristics in any given valve body even when pressure differentials vary widely; furthermore, there is no tendency for the C_V factor to drop off at high differentials as in conventional globe pattern valves.

The sum total of these improvements in operator and valve body design constitutes an important milestone in our advance toward better automatic control. *It is predicted that their adoption will eventually outmode the double-ported control valve and the spring-and-diaphragm motor.*

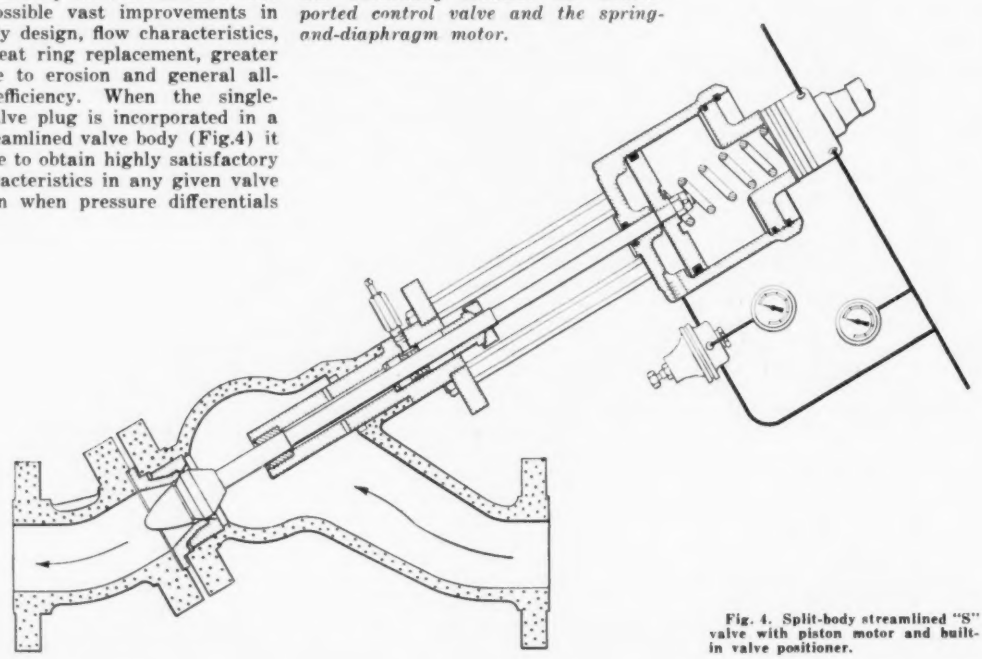

Fig. 4. Split-body streamlined "S" valve with piston motor and built-in valve positioner.

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FIFTH NATIONAL INSTRUMENT CONFERENCE *and* EXHIBIT

Program and Exhibit Guide

Memorial Auditorium

BUFFALO, N.Y.

September 18-22, 1950

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SCIENTIFIC APPARATUS MAKERS' ASSOCIATION

TENTATIVE TECHNICAL PROGRAM

Monday, September 18
10:00 A.M.

I.S.A. Session on Instrumentation for Production Processes. Assembly Hall. Chairman, Warren H. Brand (Oak Ridge National Lab., Oak Ridge, Tenn.)

"The Control Valve in Operation," by G. A. Philbrick (G. A. Philbrick Researches, Inc., Boston, Mass.) and W. H. Kidd (W. H. Kidd & Co., Richmond, Va.) Paper No. 50-1-1

"Process Instrumentation for Experimental Crystal Growing Equipment," by S. A. Hluchan (Oak Ridge National Lab., Oak Ridge, Tenn.) Paper No. 50-1-2

"Continuous Weighing Feeders in Process Control Systems," by J. E. Voytilla (E. I. du Pont de Nemours, Wilmington, Del.) Paper No. 50-1-3

A.S.M.E. Industrial Instruments and Regulators Session. Lounge. Chairman, A. A. Markson (Hagan Corp., Pittsburgh, Pa.). Vice Chairman, E. K. Newton (Hooker Electrochemical Co., Niagara Falls, N. Y.).

"Instrumentation of Open Hearth Furnace," by C. E. Mortenson (Bethlehem Steel Co., Lakawanna, N. Y.).

"Coordinated Systems of Control of Open Hearth Furnaces," by J. R. Green (Brown Instrument Co., Philadelphia, Pa.).

"Blast Furnace Instrumentation," by E. T. Mortson and S. J. Paisley (National Tube Co., McKeesport, Pa.).

"Instrumentation of Top Pressure Blast Furnaces," by F. H. Janecek (Republic Steel Corp., Cleveland, O.).

Monday, September 18
2:30 P.M.

A.S.M.E. Industrial Instruments and Regulators Session. Lounge. Chairman, Floyd S. Eckhardt (Bethlehem Steel Co., Lackawanna, N. Y.). Vice Chairman, Harvey Busch (National Analine & Chemical Co., Buffalo, N. Y.).

"The Instrumentation of the Blast Furnace for Control of Top Pressure Operation," by Dr. J. E. Stukel (Youngstown Sheet & Tube Co., Youngstown, Ohio.).

"The Instrumentation of Billet Reheating Furnaces," by C. J. Petry (American Steel & Wire Co., Worcester, Mass.).

"Radiation Pyrometry in the Steel Industry," by Donald Robertson (Leeds & Northrup Co., Philadelphia, Pa.).

"A Direct Recording Technique for Pressure Cycles in High Pressure Reciprocating Equipment," by R. A. Strub (E. I. du Pont de Nemours & Co. Inc., Charleston, W. Va.).

Tuesday, September 19
10:00 A.M.

I.S.A. Session on Instrumentation for Production Processes. Assembly Hall. Chairman, C. E. Bragg (Standard Oil Co., Whiting, Ind.)

"One Knob Production Control," by C. F. Adeszko (Corn Products Ref. Co., Argo, Ill.) Paper No. 50-2-1

"Process Monitoring Systems," by E. J. Grace, Jr. (Sun Oil Co., Philadelphia, Pa.) Paper No. 50-2-2

A.S.M.E. Industrial Instruments and Regulators Session. Lounge. Education in Instrument Engineering Panel Discussion. Chairman, Prof. D. P. Eckman (Case Institute of Technology, Cleveland, Ohio). Vice Chairman, W. E. Belcher (Brown Instrument Co., Philadelphia, Pa.).

"Instrumentation in the Mechanical Engineering Curriculum," by C. F. Kayan (Mechanical Engineering Department, Columbia University, New York, New York.).

"Measurements as a Career or Avocation," by V. F. Hanson (E. I. du Pont de Nemours & Co., Wilmington, Delaware.).

"Automatic Control Courses — Their Unifying Influence in Engineering Education," by Prof. John A. Hrones (Massachusetts Institute of Technology, Cambridge, Mass.).

A.I.P. Scientific Instrument Session. Room 224. Chairman to be announced.

"Recent Developments in Mass Spectrometry," by G. Inghram (Dept. of Physics, University of Chicago, Chicago, Ill.).

"Mass Spectrometry and its Biological Applications," by Frank S. Stein (Dept. of Physics, University of Buffalo, Buffalo, N. Y.).

"Experimental Microwave Spectroscopy," by M. W. P. Strandberg (Massachusetts Institute of Technology, Cambridge, Mass.).

I.S.A. Session on Instrumentation for Testing. Room A. Chairman to be announced.

"What Reliability Means in Industrial Circuits," by Earl R. Thomas (Consolidated Edison Co., New York, N. Y.) Paper No. 50-3-1

"Tube Life," by G. D. Hanchett (RCA, Harrison, N. J.) Paper No. 50-3-2

"Electronic Equipment Selection," by F. L. Maltby (The Bristol Co., Waterbury, Conn.) Paper No. 50-3-3

I.R.E. - Institute of Radio Engineers Technical Session. Room B. Chairman and Technical Speakers to be announced.

Tuesday, September 19
2:00 P.M.

A.S.M.E. Industrial Instruments and Regulators Joint Session with A.I.E.E. Niagara Room, Hotel Statler. Co-Chairman, Claire E. Gaylord, A.I.E.E. (N. Y. Telephone Co., Buffalo, N. Y.). Co-Chairman, Paul E. Mohn, A.S.M.E. (University of Buffalo, Buffalo, N. Y.).

"Instrument Contacts," by Erle I. Shobert II (Stackpole Carbon Co., St. Marys, Pa.).

"An Alternating Current Vector Meter," by Otto Jensen and Chas. R. Crewson (ITE Circuit Breaker Co., Philadelphia, Pa.).

"Compressibility Effects in Hydraulic Servomechanisms," by Robert Senters Wick (University of Illinois, Urbana, Ill.).

Wednesday, September 20
10:00 A.M.

I.S.A. Session on Instrumentation for Production Processes. Assembly Hall. Chairman, A. V. Novak (E. I. duPont deNemours & Co., Orange, Texas).

Panel Discussion, Subject: "Graphic Panels." Speakers to be announced.

I.S.A. Session on Instrumentation for Testing. Room A. Chairman to be announced.

"Electronic Circuit Component," by W. R. Clark (Leeds & Northrup Co., Philadelphia, Pa.) Paper No. 50-5-1

"Maintenance of Electronic Circuits," by J. J. Connolly (The Teleregister Co., New York, N. Y.) Paper No. 50-5-2

I.S.A. Inspection and Gaging Session. Room B. Chairman to be announced.

"Practical Aspects of Micrometer Servicing and Maintenance," by John W. Heuther (Canada Wire & Cable Co., Toronto, Ontario, Canada.) Paper No. 50-6-1

"A Dissertation on Precision Tools," by Raymond F. Starrett (Methods Engineer, L. S. Starrett Co., Athol, Mass.). Paper No. 50-6-2

I.S.A. Maintenance and Operation Session. Lounge. Chairman, L. C. Laird (Corn Products Refining Co., Argo, Ill.)

"Training Instrumentation Technicians for Industry," by L. G. Maxwell (Carbide & Carbon Chem. Corp., Texas City, Texas.) Paper No. 50-7-1

"Instrument and Control Maintenance in a Steel Mill," by J. H. Cuthbert (Carnegie Illinois Steel Co., Chicago, Ill.) Paper No. 50-7-2

"Applying the Penetron to Metal Thickness Measurement," by Harrison Munro and George A. Larsen. Paper No. 50-7-3

A.I.P. Scientific Instrument Session. Room 224. Chairman to be announced.

"Ultra Speed Motion Picture Photography with the Image Disector Camera," by Brian O'Brien (Institute of Optics, University of Rochester, Rochester, N. Y.).

"Measurement of Temperatures in Hot Gases," by Shirleigh Silverman (Applied Research Lab., Johns Hopkins University, Silver Spring, Md.).

"Title to be announced," by P. R. Bell (Oak Ridge National Labs., Oak Ridge, Tenn.).

Wednesday, September 20
2:30 P.M.

A.I.E.E. Electrical Instruments and Measurements Session. Lounge. Chairman to be announced.

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"Portable Harmonic Generators," by Anson A. Emmerling (General Electric Co., Schenectady, N. Y.).

"High Speed Supervision of Process Variables," by W. E. Belcher (Minneapolis-Honeywell Regulator Co., Brown Instrument Div., Philadelphia, Pa.).

"Transient Recording Cathode-Ray Oscillograph," by Douglas R. Maure (General Electric Co., Schenectady, N. Y.).

"Wiresonde Telemeter for Meteorological Measurements," by Paul R. Goudy (Square D. Co., Milwaukee, Wis.).

Thursday, September 21
10:00 A.M.

I.S.A. Session on Instrumentation for Production Processes. Assembly Hall. Chairman, D. M. Boyd, Jr. (Universal Oil Products Co., Chicago, Ill.) Panel Discussion, Subject: "Flow Control."

"Flow Control with Floating Type Controller," by D. T. Gunderson (Askania Regulator Co., Chicago, Ill.) Paper No. 50-8-1

"Factors in Precise Control of Liquid Flow," by A. R. Catheron (The Foxboro Co., Foxboro, Mass.) Paper No. 50-8-2

"Stable Control of Flow Processes," by D. B. Kirk (Moore Products Co., Philadelphia, Pa.) Paper No. 50-8-3

I.S.A. Session on Instrumentation for Testing. Room A. Chairman to be announced.

"Mobile Telemetering Instrumentation," by M. V. Kiebert, Jr., (Raymond Rosen Engineering Products, Inc., Philadelphia, Pa.) Paper No. 50-9-1

"Uses of Magnetic Tape Recording in Telemetering," by Kenneth B. Boothe (Audio & Video Products Corp., New York, N. Y.) Paper No. 50-9-2

"Some Design Considerations in Connection with the Use of High Speed Thermometry for Telemetering," by Vernon C. Westcott (Trans-Sonics, Inc., Bedford, Mass.) Paper No. 50-9-3

I.S.A. Inspection and Gaging Session. Room B. Chairman to be announced.

"Thread Gaging — Naval Ordnance Design and Practices," by Arnold Kronstadt (Gage Engineer, Naval Ordnance Laboratory, Washington, D.C.) Paper No. 50-10-1

"Production Gaging Techniques," by J. B. Wilkie (Gage Engineer, Pratt & Whitney, West Hartford, Conn.) Paper No. 50-10-2

I.S.A. Analysis Instrumentation Session. Lounge. Chairman to be announced.

"Continuous Electronic Recording of the Water Content of Oil Field Emulsions," by P. O. Engelder (Oil Well Water Locating Co., Long Beach, Calif.) Paper No. 50-11-1

"Mass Flowmeter—A Method for the Measurement of Pulsating Flow," by D. Brand and L. A. Ginsel (Royal Dutch Shell Laboratory, Delft, Holland.) Paper No. 50-11-2

"Continuous Measurement of Vapor Pressure of Petroleum Products," by Robert B. Jacobs (Standard Oil Co., Chicago, Ill.) Paper No. 50-11-3

Thursday, September 21
2:30 P.M.

I.S.A. Session on Instrumentation for Production Processes. Assembly Hall. Chairman, F. H. Trapnell (E. I. duPont deNemours, Wilmington, Del.) "Flow Control" Panel Discussion. Two papers to be announced.

A.I.E.E. Electrical Instruments and Measurements Technical Session. Niagara Room, Hotel Statler.

"Central Instrumentation System for Rocket Laboratory," by Frank A. Friswold (Lewis Flight Propulsion Lab. NACA, Cleveland, Ohio.).

"The Quality Control Indicator," by Charles J. Falk (General Electric Co.).

"Multiple-Point Tabulating Temperature Recorder," by F. A. Harshburger (Westinghouse Electric Corp., Springfield, Mass.)

Friday, September 22
10:00 A.M.

I.S.A. Session on Instrumentation for Production Processes. Assembly Hall. Chairman and papers to be announced.

I.S.A. Session on Instrumentation for Testing. Room A. Chairman to be announced.

"Potential Importance of Ultrasonic Energy in Industry," by J. W. Butterworth (Brush Development Co., Cleveland, Ohio) Paper No. 50-13-1

"An Accelerometer with Wide Range Frequency Response," by L. T. Fleming (National Bureau of Standards, Washington, D.C.) Paper No. 50-13-2

I.S.A. Analysis Instrumentation Session. Lounge. Chairman to be announced.

"A Mass Spectrometer for Monitoring Continuous Processes," by Charles F. Robinson, H. W. Washburn, Clifford E. Berry, George D. Perkins (Consolidated Engineering Corp., Pasadena, Calif.) Paper No. 50-14-1

"Recording Conductometer for Electrolytes," by L. E. Ashman, J. A. Glass, H. R. Stillwell, H. E. Jones (Mellon Institute of Industrial Research, Pittsburgh, Pa.) Paper No. 50-14-2

I.S.A. Transportation Instruments Session. Lounge. Chairman to be announced.

"Instruments in Rail Transportation Testing," by D. Clifton (Electromotive Div., General Motors Corp., Buffalo, N. Y.) Paper No. 50-15-1

"Measurement of Pressure in Locomotive Shops," by J. J. Bresnahan and J. P. Mendelsohn (Crosby Steam Gage & Valve Co.) Paper No. 50-15-2

"Instrumentation in Railway Signaling," by G. W. Baughman (Union Switch & Signal Co., Swissvale, Pa.) Paper No. 50-15-3

Instrument Maintenance Clinic

The Clinic will begin Friday, September 15th, at 1 P.M., and there will be 3 sessions on Friday, 4 sessions on Saturday and 3 sessions on Sunday. Each session will last 2 hours and classes will be limited to 12 instrument men. All sessions will be at the New York State Institute of Applied Arts and Sciences, 1685 Elmwood Ave., Buffalo.

At the conclusion of the Clinic, a certificate will be issued to all those who have attended all sessions of the Clinic.

Final registration and issuance of credentials for students will take place in the New York State Institute at 12 noon, September 15th.

Friday, September 15

12:00 noon—Registration

1:00 P.M. "Principles of Automatic Control" (Film) by G. F. Akins (Eastman Kodak Co.), and J. H. Kowalski (Eastman Kodak Co.)

3:00 P.M. "Maintenance of Control Valves" by Robert Scholar (Stauffer Chemical Co., Niagara Fall, N. Y.)

4:30 P.M. "Flow Characteristics" (Film) by Dean P. E. Mohn (University of Buffalo)

Saturday, September 16

9:00 A.M. to 11:00 A.M. "Response of Thermal Bulbs"

11:00 A.M. to 1:00 P.M. "Fabrication and Calibration of Thermocouples"

2:00 P.M. to 4:00 P.M. "Strain Gages and Position Indicators"

4:00 P.M. to 6:00 P.M. "Wet and Dry Meters"

An entertainment program has been arranged for the Clinic students on Saturday night. They will be guests of the Niagara Frontier Section, I.S.A.

Sunday, September 17

10:00 A.M. to 12:00 noon "Primary Flow Devices"

1:00 P.M. to 3:00 P.M. "Typical Bridge Circuits—Potentiometers"

3:00 P.M. to 5:00 P.M. "Shop Practices and Equipment"

Automatic Control Demonstration

At the first 3 National Instrument Conferences, J. Akins and John Kowalski gave their Automatic Control Demonstration. This demonstration has been filmed in color and sound and in addition to showing the film at the General Meeting of the I.S.A., it will be shown on Monday, Tuesday and Thursday evening in the Assembly Hall of the Memorial Auditorium at 8 P.M.

DESCRIPTIVE LIST of the EXHIBITS and PERSONNEL in ATTENDANCE

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Harrisburg, Pa. 413
Exhibiting: Solderless Wire Terminals; Crimping Tools; Automatic Terminal Crimping Machine Champ Tool (Terminal Crimper, Wire Stripper, Cutter, Machine Screw Cutter) Formula 21 (Liquid Wire Stripper).
In Attendance: James L. Bergstresser, Advertising; T. C. Freedom, Engrg. Staff; J. O. Baker, J. E. Nestor, Sales Staff.

American Institute Electrical Engineers
New York, N. Y. 327
Exhibiting: AIEE Publications; Information concerning AIEE.
In Attendance: Berton Rice, Chairman Local AIEE Section; A. J. Hornfeck, Chairman of Committee representing AIEE Committee on Instruments & Measurements; J. J. Bowen, Chairman General Arrangements for AIEE.

American Institute of Physics
New York, N. Y. 108
Exhibiting: "Review of Scientific Instruments"; "Journal of Applied Physics"; "Physics Today"; "The Journal of the Acoustical Society of America"; "American Journal of Physics".

American Instrument Co.
Silver Spring, Md. 440, 442
Exhibiting: New Humidity-Temperature Apparatus with Program Control; Supersensitive and Electronic Relays; Dual-purpose Constant Temperature Bath. Temperature and Humidity Cabinet with special switch for rapidly testing resistors; Subzero test cabinet.
In Attendance: W. H. Reynolds; C. E. Ohlheiser; W. H. Stewart; F. Quinn.

American Meter Co.
Philadelphia 2, Pa. 511, 513, 515
Exhibiting: New A-88 Flowmeter includes improved check valves, improved pulsation dampner, extended high side chamber; new A-88 Transmitter and Controller, new design pneumatic flapper and nozzle type transmitter and controller; new A-88 Square Root Transmitter; new Derivitive Controller, new design pneumatic controller for utilizing rate responses; new Poly Pneumatic Controller, remote set controller to receive pneumatic signals from two variables and position the control point of the third according to the sum difference, product or ratio of the signals. Orifice meters, positive displacement meters, pressure regulators, test meters (wet and dry types), meter runs, orifice fittings, laboratory gas testing apparatus, orifice flanges, orifice discs. Engineering of measurement and control of flow, pressure, level, etc. for liquids, gas and steam.
In Attendance: W. G. Hamilton, Jr., V. P. Sales; A. F. Benson, V.P. Res. & Prod.; A. Costa, L. Hickman, B. McKalip, J. T. Pruet, R. Conners, A. S. Chatfield, Sales Engrs.; A. B. Cloud, Dist. Sales Manager; W. Kehoe, H. Shroyer, R. Gray, D. Wiley, Research Engrs.; R. Wilmarth, Asst. Mgr.

American Society of Mechanical Engineers, Industrial Instruments & Regulators Division
New York, N. Y. 135
Exhibiting: Publications; Information.

Anders Co.
New York 17, N. Y. 405
Exhibiting: Fully Automatic Dryer; Engineering of Instrument Air Drying and Cleaning.
In Attendance: Edwin W. Anders, Pres.; Emil C. Creutz, V. P.; B. W. Barker, Buffalo Rep.; Harry Lee, Adv. Mgr.

Anderson & Sons, Inc.
Westfield, Mass. 231, 233
Exhibiting: New "Etched Monel", most recent material used in the nameplate industry. Complete line of engraved, embossed, lithographed and etched instrument panels, nomenclature plates for all industrial applications. Plaques, service awards, novelty and souvenir items.
In Attendance: Roland E. Anderson, Pres. & Sales Mgr.; A. M. Anderson, D. M. Anderson, W. H. Smith, Sales.

Annin Co.
Los Angeles 23, Calif. 219
Exhibiting: New 1520 Cylinder Operator-solenoid. 1560 Domotor Control Valve.
In Attendance: D. H. Annin, Owner; Paul Condit, Wm. J. Gallagher, Howard W. Johnson, Carroll A. Ross, Representatives.

Assembly Products, Inc.
Chagrin Falls, Ohio 222
Exhibiting: New Panel Meters, Voltmeters, Ammeters, etc., including clear plastic meters, sizes from one inch to four and one half inches; Simplytrol Pyrometers, indicating and controlling; Simplytrol contact meter-relays.
In Attendance: Bradley Thompson, Pres. & S.M.; Agnes Thompson; W. K. Skidmore, N. Y. City Sales; Martha Skidmore.

Atlas Valve Co.
Newark 5, N. J. 325
Exhibiting: New Snap Action Pilot Valve for automatically closing off air supply to and bleeding air from diaphragm motor valves in event of instrument air dropping below pre-determined pressure; new 235 Adjustable Lift-Opening Lever Operated Control Valve for maintaining required flow ratio between two variables; new 236 Type Cam and Lever Pressure Control Valve for maintaining downstream pressure in proportion to another variable. Pressure reducing valves; temperature regulators, boiler feed water regulators, air actuated pressure controllers, pump governors.
In Attendance: George E. Breece, Sec. & Treas.; Harry T. Wentworth, Ch. Engr.

Automatic Temperature Control Co.
Philadelphia 44, Pa. 417
Exhibiting: Vernier Set timer, Cycle Progress timer, cam timers, dial timers, electronic timers, pneaumatic timers, input controllers, valves, motorized valve operators, electronic relay, delay timers, impulse counters, revolution timers, time switches, Duo-Set timers, differential transformer, round scale indicator, recorder controller, multi-channel indicator, absolute pressure cell, Torsion load bar cell, Expermential Package, meter indicator, proportioning relays.
In Attendance: George J. Ebling, Sales Pro. Mgr.; W. W. Winters, Sales Mgr.; I. G. Johanson, V.P.; W. D. MacGeorge, Ch. Engr.

Bacharach Industrial Instrument Co.
Pittsburgh 8, Pa. 105
Exhibiting: New Portable Testing Instruments for pressure, temperature, gas analysis and smoke measurement in processing, refining and manufacturing operations.
In Attendance: C. W. Craychee; John W. Smith.

Baird Associates, Inc.
Cambridge 38, Mass. 225
Exhibiting: Infrared Gas Analyser.
In Attendance: S. H. Walters, Tech. Sales Mgr.; J. M. Devine, P. C. Hutchinson, Sales Engr.

Baker Co.
Maplewood, Maine 324
Exhibiting: New Tools for assembly or disassembly of small precision ball bearings into equipment; Miscellaneous instrument assembly equipment; Sterilshield Cabinets, workspace dustfree and sterile for assembly of delicate equipment or for antiseptic lab work.
In Attendance: Arthur K. Baker, Ch. Engr.; Wm. Manty, Edmund Piotrowski, N. Y. Sales.

Barber-Colman Co.
Rockford, Ill. 414
Exhibiting: Shaded Pole Induction Motors (complete line) with several product applications of these motors; Industrial type Motor-operated Valves operating devices plus electronic relay.
In Attendance: F. D. Utler; E. A. Greenlee; H. E. Shugars.

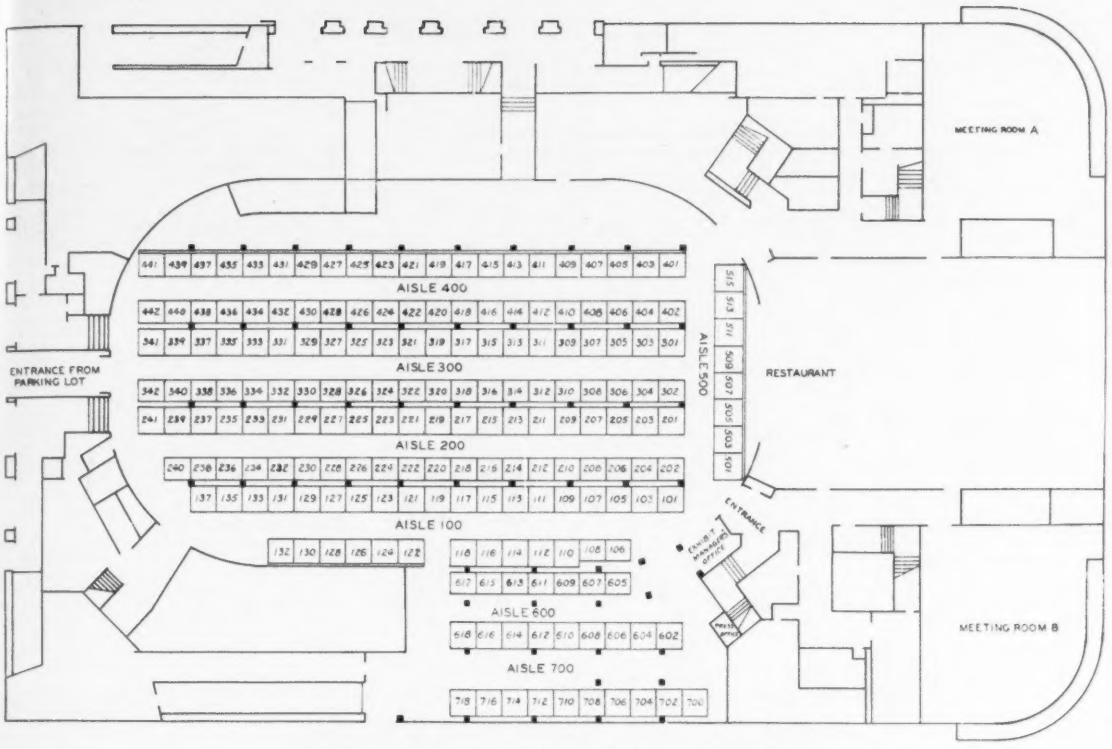
Barton Instrument Co.
Los Angeles 22, Calif. 206
Exhibiting: Model 163 Flow Indicator; Model 200 Flow Indicator; Model 202 Flow Recorder. All instruments rupture proof bellows type, with internal, adjustable pulsation dampener.
In Attendance: Claude B. Nolte, V. P. Sales; M. S. Jacobs, Pgh. Rep.; S. J. Adams, Buffalo Rep.

Beckman Instruments, Inc.
South Pasadena, Calif. 234, 236, 238
Exhibiting: New Automatic Titractor, performs neutralization, oxidation-reduction and routine and special titrations to accuracy of 0.1% in one to two minutes; new AC-pH Adjustor; new AC-pH Meter. Spectrophotometer, pH Meters, Radio Activity Meters.
In Attendance: A. O. Beckman, Pres.; T. F. Herring, Sales Mgr.; R. W. Moulton, Sales Dev. Mgr.; T. H. Barton, E. D. Haller, Sales Reps.

James G. Biddle Co.
Philadelphia 7, Pa. 239
Exhibiting: New Rectifier-Operated Meg Type of Megger Insulation Tester; new Dual-operated Meg Type of Megger Insulation Tester operated either by hand or by rectifier; new T-21 Frahm Resonant Reed Miniature Tachometer for hand use and permanent mounting; new CVM Type of Megger Insulation Tester; new CVM Type of Megger Ground Tester for measuring resistance to earth of ground connections such as rods, pipes, buried plate and metallic structures; new High Range Megger Insulation Tester with higher and wider ranges measures up to 50,000 megohms, 2500 volts d-c; new Jagabi Centrifugal Hand Tachometers with acceleration and overspeed protection; new Frahm Resonant Reed Frequency Sensitive Relay will respond to a single, narrow band of frequencies; new Portable Spotlight Galvanometer, "Megger" insulation and resistance testers, "Ducter" low resistance ohmmeters, Megger ground resistance testers, Frahm resonant reed tachometers and frequency meters, Jagabi speed measuring instruments, Jagabi Lubri-tact rheostats, Apiezon Oils, greases and waxes, Pointolite lamps, "TRR" transformer turn ratio test set, Biddle impulse cable fault locator, Repair service, application engineering.
In Attendance: A. Q. Lange, Engr.; Stuart Sommer, Adv. Mgr.

J. Bishop Co. Platinum Works
Malvern, Pa. 131
Exhibiting: Platinum and Platinum Alloy Products; Stainless steel capillary, pressure and mechanical tubing; Stainless steel tubular specialties and fabricated parts.
In Attendance: Ellis E. Comfort, Gen. Supt.; George M. Hickey, Prod. Dev. Ch.; Paul C. Kehoe, Sales Dept.; David Lundy, Sales Engr.

Black, Sivalls & Bryson Inc.
Climax Controls Div.
Tulsa, Okla. 213, 215
Exhibiting: New Displacement Type Liquid Level Unit with pneumatically operated pressure switch for 3 light level indications; new Type 149 - 780 - 45 Boiler Level Regulators; new Type 320 Weight Loaded Diaphragm Actuated Pressure Regulators; new Type 228 Reversing Relay; new Control Valve Bodies. Continuous drainers, liquid level controllers, diaphragm control valves, 3 way diaphragm control valves, safety heads, pressure controllers. Engineering services on control applications.
In Attendance: Jimmy Dvoracek, Sales Mgr.; Ross B. Baze, Asst. Sales Mgr.; A. J. Hanssen, Ch. Engr.; J. F. Myers, Sales Mgr. Special Pro. Div.; W. M. McGinnis.



FIFTH ANNUAL INSTRUMENT EXHIBIT

Municipal Auditorium, Buffalo, New York, September 18-28, 1950

EXHIBIT HOURS: Monday, Tuesday and Thursday, 12 noon to 10 P.M.; Wednesday and Friday, 10 A.M. to 6 P.M.

Mgr. Houston Div.; James S. Simmons, Mgr. Corpus Christi Branch.

Brabender Corp.
Rochelle Park, N. J. 316

Exhibiting: Plastograph; Pressure Thermostat; Viscograph; Semi-Automatic Moisture Tester; Recording Viscosimeter.

In Attendance: Arthur Hartkopf, Pres.

Brookfield Engineering Labs. Inc.
Stoughton, Mass. 605

Exhibiting: New U1 Adapter, ultra-low range viscosity attachment for use with LVF model Viscometer; new Motorized Stand, used with all model Viscometers for testing paste-like and semi-solid materials with poor flow properties. Synchro-Lectric Viscometer; Counter-Rotating Mixer; Viscotrol. Engineering services for abnormal viscosity problems.

In Attendance: Wm Bernard Brookfield, Pres. & S.M.; Harlow M. Chandler, Export Mgr.; R. A. Brookfield, V.P. & Prod. Mgr.

Brooks Rotameter Co.
Lansdale, Pa. 423, 425

Exhibiting: New Memo Trol, magnetic, self-operated indicating controlling rotameter; new Full-view Rotameter with Amored Safety Seal Shielding; new Mite Rota-Bubbler for purge and liquid level applications. Full-view safety shielded rotameter, Full-view Hi-accuracy rotameter, Multi-flow rotameter, Multi-tube laboratory kit, Triple meter laboratory kit, Hi-pressure armored rotameter, Inductronic recorder, new Mite Rota-Bubbler.

In Attendance: Douglass N. Brooks, Pres.; Nelson S. Brooks, Applications Engr.; O. R. Lawrence, John Kirkpatrick, Sales Engrs.; Ernest Nyce, Instrument Mechanic.

Brush Development Co.
Cleveland, Ohio 415, 417

Exhibiting: New BL-312 Strain Gage Switching Box for quickly selecting any of 6 independent strain gages for recording; new BL-226 Six Channel Direct Inking Oscillograph contains 6 pen-motors recording on 12" wide chart paper; new BL-314 Uniformity Analyzer records percent deviation from normal of cotton and wool and may be adapted for nylon, rayon and other plastics; new BL-221 and BL-222 Combination Electric Stylus and Direct Inking Oscillographs; new Model BL-944 Power Supply to furnish voltage of electric stylus. BL-103 Surface Analyzer, BL-320 Universal Strain Amplifier, BL-928 Dual Channel D. C. Amplifier .

In Attendance: A. J. W. Novak; E. M. Hensley; Carl Novorska; H. J. Harsant.

Bridgeport Thermostat Div.
Robertshaw-Fulton Controls Co.
Bridgeport, Conn. 228

Exhibiting: Metal Bellows and Bellows Assemblies. Products used in various types of thermostatic and pressure actuated and controlled devices.

In Attendance: A. D. Rapuano, V. P. & Gen. Mgr.; C. F. Ahlheim, Asst. Gen. Sales Mgr.; D. L. Morgan, Asst. Ch. Eng.; J. F. Mahne, Asst. Sales Mgr.; D. W. Mason, Sales Rep.

Buffalo Meter Co.
Buffalo 14, N. Y. 111

Exhibiting: New Electricontact Liquid Meters, with impulse-transmitter registers, for remote integration, flow control, or control of meter-actuated mechanism. Sizes ½" to 6" for all non-corrosive liquids and most corrosive chemicals. Liquid Meters, (volumetric type) and accessories.

In Attendance: Herbert F. Barrett, Sales Mgr.; William G. Carter, Asst. to Sales Mgr.; Sales Reps.

Bureau of Reclamation
Denver, Colo. 618

Exhibiting: Typical instruments used in laboratory research and testing of materials and of hydraulic and structural models; Instruments used in field tests on full scale structures such as dams, canals, bridges, penstocks, etc.

In Attendance: Harold E. Hosticka, Physicist, Structural Research Lab.

Burgess Battery Co.
Freeport, Ill. 318

Exhibiting: New Flashlight Battery, metal seal and plastic case; improved Flat Cells in Multiple Cell Batteries; new U200 Battery, 300 volt, for radiation survey meters. Dry batteries, reserve batteries. Engineering service, new battery design, technical data, special batteries for special applications.

In Attendance: Louis D. Foust, Sales Mgr.

Century Geophysical Corp.
Tulsa, Okla. 118

Exhibiting: New Miniature Shock Oscillographs; new Flight Oscillographs; new Linear-Integrating Amplifiers; new Carrier Amplifier System. Oscillographs, Galvanometers, Amplifiers. Vibration stress analysis.

In Attendance: T. J. Ray, Jr., Sales Mgr.; J. A. Stafford, Ch. Engr.; C. E. Hendricks, V. P.; A. D. Barnes, Sales & Service Engr.

Chemiquip Co.
Brooklyn, N. Y. 436

Exhibiting: New Pulsation Dampeners, available in ¼"x¼" NPT or ½"x½" NPT, two different size pipe connections as standard, fabricated in all monel (including porous membrane), all stainless steel (including porous membrane), brass (with stainless steel porous membrane, Pulsation dampeners.

In Attendance: Julian A. Lipman, Gen. Mgr.; Sylvia Sichel, Sec. to S. M.

Clapp Instrument Co.
Webster, Mass. 133

Exhibiting: New Custom Acragage, ultimate precision in a Bourdon Tube instrument; new Acragage Shockstop, eliminates need for snubbers; new Pneumatic Transmitter Acragage; new Receiver Acragage; new Electric Transmitter Acragage; new Clip-On-Ring Acragage; Solid front and solid back acragage, Capillary bleeder, illuminated dial gauges, test gauges.

In Attendance: A. S. Brown, Pres.; A. E. Campbell, Sales Mgr.; John Meyer, Nick Fehlinger, Frank Riggio, Art Nelson, John Kirkpatrick, Sales Rep.

UNIVERSITY OF MICHIGAN LIBRARIES

Conoflow Corp.
Philadelphia 3, Pa. 439, 441
Exhibiting: New "Cono Airpak", combination regulator and filter for instrument air supply service; new "Cono Rotomotor", rotary gear-driven pneumatic positioning device for large valves, blast gates, sliding valves, and other heavy duty applications involving long travel, accuracy of positioning and necessity of holding last position in the event of air failure; new Line of Pneumatic Cylinder Operators using both the internal and external type positioning device. Purge units, panels, air pressure regulators, spring and diaphragm type "Conomotors", springless "Conomotors", barstock body valves, Saunders valve assemblies, pneumatic current controller. Manufacturer of special items to customer's standards.
In Attendance: R. B. Werey, Pres.; M. M. Watkins, V. P. & Treas.; J. C. Koch, Sales Mgr.; E. K. Graham, Ch Engr.; D. P. Eckman, Consultant; J. R. Simpson, Sales Engr.; J. B. Madison, Sales Engr.; District Reps.

Consolidated Engineering Corp.
Pasadena 4, Calif. 107, 109
Exhibiting: New Telereader-Telecorder Data-Reduction System, speed analysis of oscillograph data; new Type 5-116 Oscillograph, records 9 active traces plus 2 reference traces; new Diatron-20, Type 32-103, compact mass spectrometer element. Leak detector. Titrilog, recording system D.
In Attendance: George H. West, Dir. of Adv.; H. W. Ruby, S. M. Electromechanical Div.; A. P. Gifford, S. M. Chem. Inst. Div.; C. J. Underwood, Jr.; Ren. Welch, Joseph Davidson, Sales Engrs.

Continental Equipment Co.
Coraopolis, Pa. 209, 211
Exhibiting: Butterfly Valves, manual and automatic operation, metal and rubber seated.
In Attendance: Arthur M. Capper, Pres.; Charles A. Dally, Asst. Ch. Engr.; Wm. F. Hartmann.

Cornell Aeronautical Laboratory
Buffalo 21, N. Y. 613

Corry Instrument Co.
Corry, Pa. 222
Exhibiting: New Manometer, U type surface mounting; new Manometer, portable, adjustable angle U type; new Micromanometers, U type, electric indicating, readable to .002" water or mercury. Manometers, well-type, flush and surface mounting; Pitot tubes, single bend type, fixed or portable.
In Attendance: H. S. Vaughn, Co-Owner; W. K. Shiadledecker, Salesman.

R. W. Cramer Co., Inc.
Centerbrook, Conn. 438
Exhibiting: New Self-Starting Synchronous Motor with differential gear clutch; Type SCS imparts motion to output shaft when clutch relay is energized; Type SCR rotates output shaft when clutch relay is deenergized. Interval timers, various time delay relays, pulse timers, cycle timers, percentage timers, duplex timers, multicontact timers, special timers, running time meters, synchronous timing motors with gear trains ranging from 60 RPM to ¼ RPD. Development of special synchronous motor operated timing devices.
In Attendance: R. W. Cramer, Pres.; F. R. Brophy, V. P.; Alan DeCew, N. Y. Sales Rep.; Horace Goss, Sales Mgr.

CRL School of Electronics, Inc.
Hartford, Conn. 615
Exhibiting: New Electronic Voltmeter, providing "tailored-to-suit" courses of study in instrumentation to fit specilized needs. Residence courses in Industrial Instrumentation, Electronics, Radio, FM, Television.
In Attendance: S. I. Ward, Pres.; Dana S. Merriman, Administrator; John A. Settle, Instructor.

Daven Co.
Newark, N. J. 328
Exhibiting: Cooperating with industry in .001 volts to 100 volts, frequency range 10 cycles to 25,00 cycles, high imput impedance of 500,000 ohms, low imput capacity to 6 MMFO; new R. F. Attenuators, accurate from D. C. to 225 M. C., available with 100 DB total in one DB steps. Audio attenuators, video attenuators, R. F. attenuators, rotary switches, precision wire wound resistors, test equipment. Special electronic equipment development and design.
In Attendance: Edward L. Grayson, Sales Mgr.; Kenneth Grayson, Sales Engr.; Lewis Newman, Pres.

Davis Instruments Div., Davis Emergency Equipment Co., Inc.
Newark 4, N. J. 210
Exhibiting: New Indicating and Recording "Package Unit" Fail Safe Combustible Gas Alarm System; Continuous Indicating and Recording Micro Gas Analyzer for chlorinated hydrocarbons in toxic range; Continuous Indicating and Recording Flue Gas Analyzer operating on thermal conductivity principle. Portable and continuous gas indicating devices; Vapotesters; Halide Meter. Specialists in gas analysis and control instrumentation, operating on three basic principles — catalytic combustion, thermal conductivity, electro conductivity.
In Attendance: F. R. Davis, Pres.; F. Taylor, Jr. Mgr.; Alexander E. Lawson, Jr., Engr.

De Zurik Shower Co.
Sartell, Minn. 204
Exhibiting: New Easy Operating Plug Valves, equipped with positioner for operation with air instrumentation; new Float Operated Liquid Level Controller, for operation in conjunction with cylinder operated valves; new air operator unit for 3" and smaller easy operating plug valves. Valves.
In Attendance: David De Zurik; Personnel from New York, Pittsburgh & Buffalo offices.

Diamond Power Specialty Corp.
Lancaster, Ohio 334
Exhibiting: New "Utiliscope", industrial television, wired line system with camera connected direct to monitor. Soot blowers; boiler water-level gauges for over 500 PSI up to 3000 PSI; smoke indicators; air control equipment. Engineering field service.
In Attendance: J. A. Good, Mgr.; Electronic Dept.; J. C. Parker, A. R. Black, Sales Service Engrs.

Doschek and Walker, Inc.
Crafton, Pa. 609
Exhibiting: New Metalsorter; sorts steels (carbon and stainless) and nonferrous alloys.
In Attendance: Anthony Doschek, R. A. Walker, Louise Doschek.

Eagle Signal Corp.
Moline, Ill. 410
Exhibiting: Reset timers, processing timers, predetermining counters.
In Attendance: D. J. Munhall, Sales Rep.

Edin Co., Inc.
Worchester 8, Mass. 604
Exhibiting: New Ink Recording Oscillographs; new Oscillograph Amplifiers with a sensitivity as high as one micro volt per millimeter deflection, frequency response up to 300 cycles per second; new Electronic Integrating Tachometers. Electro-Medical equipment; Electrocardiographs; Electroencephalographs. Design of special recording equipment and single and multiple channel units. Repair and rebuilding chart drives and recording galvanometers.
In Attendance: Neil R. Seitzman, Field Engr.; Murray W. Edinburg, Treas.

Electric Auto-Lite Co.
Toledo 1, Ohio 116
Exhibiting: Recording Thermometers, dial indicating thermometers, recording pressure, vacuum and compound gauges, fast freeze thermometers.
In Attendance: L. B. Murphy, Sales Mgr.; Thomas Murchie, R. R. Hopkins, R. R. Davis, Sales Reps.; S. Page Butt. Advertising Executive.

Ellison Draft Gauge Co.
Chicago 10, Ill. 212
Exhibiting: New Pointer Draft Gage Alarm for minus, plus or differential readings and for either high or low draft alarm or both. Straight line pointer diafram draft gages; inclined draft gages, stationary and portable; inclined-vertical tube gages; vertical tube gages, oil, heavy liquids and mercury; U gages, stationary and portable; air filter gages, dial and inclined; satuator gages; Pitot tubes; U Path steam calorimeter; portable gas analyzer Orsat type.
In Attendance: M. S. Jacobs, Walter F. Gieryk, Robert B. Kerr, Richard Moses.

A. H. Emery Co.
Stanford, Conn. 336
Exhibiting: Hydraulic Weighing System for measurement of Jet Engine Thrust, Rocket Thrust and general dynamometer installations; High Precision Bourdon Gauges; Hydraulic Crane Scales and Remote Load Transmitter; Hydraulic Load Cells operating in conjunction with special recording apparatus for dynamic testing. Hydraulic and pneumatic load cells and weighing systems, testing machines, wind tunnel balances, special test apparatus. Complete engineering designing and manufacturing facilities for force weighing and measuring apparatus.
In Attendance: M. C. Tate, A. H. Emery, 3rd, Otto Heise, E. J. Ryan, H. A. Mills.

Fenwall, Inc.
Ashland, Mass. 333
Exhibiting: Thermoswitch (R); Thermostats; Industrial Fire Detectors; Aircraft Fire Detectors and Temperature Controls. Temperature Control Engineering.
In Attendance: Carl T. Grosswendt, Sales Engr.; D. K. Cooper, Charles J. Morgan, Jr., Buffalo Sales Reps.; Thomas Carse, Albany Sales Rep.; James E. Naylor, Syracuse Sales Rep.; H. J. Rittenhouse, J. L. McGuire, Rochester Sales Rep.

Fisher Governor Co.
Marshalltown, Iowa ...429, 431, 433
Exhibiting: New Teflon Three-Ring, V-Ring Packing; new Type 57-TL Meter Run Shut-Off Diaphragm Motor Valve. Series 2405-249 displacement float liquid level controllers, diaphragm motor valves, positioners, pressure loaded diaphragm motor valve tops, Wizard air operated pressure controllers, panel loaders, self-contained pressure reducing valves.
In Attendance: J. W. Fisher, Pres.; P. A. Elfers, V. P. & Sales Mgr.; R. A. Engel, V. P.; Lyle E. Eige, Asst. Sales Mgr.; G. F. Brockett, Ch. Engr.; C. F. King, Dir. Research; Warren Ehrke, Robert Reed, Harold Kinney, Sales Engrs.

Fredric Flader, Inc.
Toledo 12, Ohio 416
Exhibiting: New Ray-Dec Decimal Counter, an electronic sealing circuit designed to count and record total number of impulses delivered to its imput circuits; new Teledyne Self Balancing Potentiometer reproduces a voltage on bucking potentiometer equal in magnitude to unbalanced output voltage supplied by strain gage bridge in pickup instrument; new Logarithmic Resistor, a line of precision variable resistors with resistance ranges as high as 1,000,000:1; new Electrostatic Recorder Set, records for 40 hours the magnitude and polarity of the external electrostatic field between two arbitrary points about an airplane in flight; new Master Tachometer Test Stand automatically maintains an output speed between 100 and 10,000 revolutions 1 min. to accuracy within 0.1c%; new Telemetering Receiving Set, Navy designed 10-channel pulse time modulated telemetering system complete with UHF receiver, discriminators, pulse sweep generators, and channel amplifiers; new Telidyne Automatic Printing Scale comprises a load cell and a printing counter directly actuated by an electromechanical self-balancing potentiometer; new Anstat Insulation Tester AT-600 high voltage instrument designed for testing anti-precipitation static aircraft antenna system. Specializes in design, development, and manufacturing services to meet laboratory, industrial and aeronautical requirements.
In Attendance Dr. V. B. Corey, Dir. of Research; G. O. Haglund, Mgr. Engineering & Physics Dept.; J. H. Green, Ch. Engr. Physics Dept.; J. C. Lauderback, Asst. Administrator; J. W. McGee, Mgr. Anstat Dept.; R. J. Cousineau, Engr. Rep.

Fulton Sylphon Div., Robertshaw-Fulton Controls Co.
Knoxville, Tenn. 337, 339, 341
Exhibiting: Temperature Controls; Packless Valves; Bellows and Bellows Assemblies.
In Attendance: E. D. Rogers, Adv. Mgr.; L. S. Dysart, Asst. Sales Mgr.; D. D. Gordon, Sales Engr.; D. W. Mason, Dist. Sales Rep.

General Electric Co.
Schenectady 5, N. Y. ..301, 303, 305
Exhibiting: Quality Control Indicator; Fractional H-P Dynamometer; Alpha Scin.

tillation Counter; P.M. 18 Oscillograph with Land Camera; C. E. Photoelectric Recorder; A-K-2 Hook-on Wattmeter; A-K-1 Hook-on Voltammeter; Hand Tachometer; Thermocouple Vacuum Gage; P-3 Voltmeter; Viscosimeters; Self-balancing Potentiometer; DV-9 Voltmeter; Hipot Limited Current Tester; Type H. Leak Detector.

In Attendance: W. E. Herman, Mgr. Sales. Lab. Prod. Sect., Spec. Prod. Div.; W. C. Hutchins, Mgr. Spec. Prod. Div.; J. L. McLoughlin, Mgr. A. & S. P. Div.; Nelson Gildersleeve, In charge Process Insts., Elect. Insts. Sec., Meter & Insts. Div.; G. A. Requa, Exhibit Supervisor; D. Eldred, C. W. Merritt, H. Kuhn, G. W. Engler, J. R. Thrower, G. W. Madsen.

G. M. Giannini & Co.
Springfield, N. J. 338

Exhibiting: New Pressure Transmitters providing accurate electrical signals not requiring amplification; new Direct Writing Inkless Recorder producing black line trace on heat-sensitive paper. Telemetering transmitters, recorders, gyros, microtorque potentiometers, rectilinear potentiometers, control systems, fuel metering devices. Adaptation of microtorque potentiometers to standard indicating gauges to obtain an electrical signal for recording or remote indication.

In Attendance: G. M. Giannini, Pres.; C. H. Colvin, V.P.; R. P. Luce, Jr., Eastern Sales Mgr.; H. T. Brierley, E. R. Davis, A. C. Hughes, Field Engrs.

Gotham Instruments Div., American Machine and Metals, Inc.
New York 12, N. Y. 340, 342

Exhibiting: New Program Recorder-Controller guarantees repetition of a predetermined control program with relation to temperature or pressure; new Recorders and Controllers with "Convertible" features to permit interchangeability of parts in the field. Dial and industrial indicating thermometers; Indicating pressure gauges; Recording temperature and pressure instruments; Automatic timers.

In Attendance: Walter J. Halpern, Gen. Mgr.; Robert Hamerschlag, Sales Mgr.; Milton Mollick, Engr.

Gow-Mac Instrument Co.
Newark 5, N. J. 406

Exhibiting: New Thermal Conductivity Gas Sensing Elements for faster response and faster purge; new Special Double Mass Model for use with recorders and controllers. "Ever-Tite" thermal conductivity units.

In Attendance: James L. McFadden, Pres.

Green Instrument Co.
Cambridge 39, Mass. 434

Exhibiting: New Radial Attachment with automatic spacing, designed to engrave from a straight line of type on radius within the limits of the 5" diameter table. Spacing between letters is continuously variable. Engraver Model No. 106 three dimensional pantograph engraver, rotary tables, self-centering vises, clamping fixtures, cutter grinder. Special machinery for production engraving.

In Attendance: Edwin T. Green, Pres.; W. Franklin Fullerton, Sales Mgr.; Wm. Richter, Sales Rep.

Hammel-Dahl Co.
Providence 3, R. I. 501, 503

Exhibiting: New Automatic Boiler Recirculating Feed Control Valves. Diaphragm operated control valves. Engineering for flow, liquid level, pressure and temperature control.

In Attendance: E. T. Dahl, Pres.; David Golner, Asst. S.M..; John Curran, Design Engr.; Otto Kneisel, Div. Engr.; Robert Carter, Harold Miller, Wayne Farley, John E. Charsha, Jr. Sales Engrs.

Hankison Corp.
Pittsburgh 33, Pa. 312

Exhibiting: New Condensifilter, compressed air dehydrator and cleaner, gives subsaturated air, condensate automatically discharged, solid contamination "Flannel-Screened", completely automatic; new Fluid Pump operates up to 2000 psi and temperatures above 600 degrees F., stainless steel and other corrosion-resistance alloys, capacities up to 300 gpm, differentials up to 500 psi.

In Attendance: Paul M. Hankison, Pres.; Donald K. Bice, Service Mgr.; Morgan C. Larkin, Sales Rep.

A. W. Haydon Co.
Waterbury, Conn. 110

Exhibiting: New Governed Direct Current Timing Motor series 5700 with extremely close speed regulation; new hermetically sealed Time Delay Relays and Repeat Cycle Timers for both A.C. and D.C.; new Standardized A.C. Timing Motors. D.C. timing motors, A.C. and D.C. repeat cycle timers, A.C. and D.C. time delay relays.

In Attendance: A. W. Haydon, Pres.; E. A. Diemand, V.P.; Fred Hoffman, R. L. Seymour, Sales Engrs.

Hays Corp.
Michigan City, Ind. 112, 114

Exhibiting: New Veriflow Meter and Veritrol, indicating and controlling fluids including corrosive liquids; new Magno-Therm Oxygen Recorder based on paramagnetic qualities of Oxygen; new Re-Designed Draft Gage; new Magne-Clutch Flow Meter. Water operated CO2 recorder, flow meters, combustion control, boiler efficiency meter, Conder-Therm CO2 recorder, draft recorder, two pen electronic recorder.

In Attendance: Phil T. Sprague, Pres.; Shirl M. Rudolph, V.P. Charge of Sales; Wm. H. Pugsley, V.P. Charge Field Research; Orville Riggs, Ch. Project Engr.; Jack Tipton, Asst. Project Engr.; Phil Sprague, Jr., Advtg. Mgr.; Don Burns, Ch. Control Engr.

Heiland Research Corp.
Denver Colo. 129

Exhibiting: Oscillograph Recorders and associate equipment.

In Attendance: Donal B. Clow, Mgr. Instrument Sales; Russell Young, Bryn Mawr, Pa. Rep.; Gerald B. Miller, Hollywood, Calif. Rep.; M. P. Odell, Cleveland, O. Rep.; Hugh W. Marsland, Chicago, Ill. Rep.; Philip M. LaHue, Ch. Engr.

Heise Bourdon Tube Co.
Newtown, Conn. 336

Exhibiting: Precision pressure gauges.

In Attendance: O. W. Heise, Pres.

Helicoid Gage Div., American Chain & Cable Co.
Bridgeport, Conn. 411

Exhibiting: New Square Flush Case Gage with or without illuminated dial. Presssure gages.

In Attendance: Jos. V. Tracy, Sales Mgr.; E. H. Grauel, Ch. Engr.

Helipot Corp.
South Pasadena, Calif 234, 236, 238

Exhibiting: New miniature ultra low torque, single turn, wire wound Potentiometer, for use in Guided Missile telemetering; new miniature 10-turn Helipot Potentiometer, ¾" O.D. for use in aircraft instrumentation and other applications where space is at a premium; new 2" diameter Precision Potentiometer, for high quality instrument control and servo mechanism application. Potentiometers and duodials. Development of high precision Potentiometer equipment and testing devices.

In Attendance: D. C. Duncan, Sales Mfg.; E. A. Ossmann, H. N. Heasley, A. R. Satullo, Sales Engrs.

Hills McCanna Co.
Chicago 18, Ill. 137

Exhibiting: Diaphragm valves (Saunders Pat.); Type U and Type K hydraulic drive metering pumps; Magnesium precision sand castings. Valving and metering of acids, alkalies, etc. in the process and power industries.

In Attendance: F. R. Grassle, Supt.; R. J. Kidde. Adv. & Pro. Mgr.; R. McFarland, Technical Supervisor; R. Schermer, N. Y. Office; D. D. Foster, Pgh. Office.

Holtzer-Cabot Div. National Pneumatic Co.
Boston 19, Mass. 309

Exhibiting: New RBDP-0805 Permanent-Magnet D.C. Motor for intermittent duty, with ratings up to 1/100 H.P. and speeds to 20000 RPM, meets Air Force Specifications; New RBDS-1810 Servo Motor for instrument applications calling for extreme accuracy. Type R-25 and Type R-37 instrument motors; electronically controlled insulation resistance tester.

In Attendance: C. T. Button, Dir. Sales; C. L. Heckman, Sales Mgr.; A. E. Smith, Adv. Mgr.; F. W. Anderson, R. L. Graves, A. V. Molloy, L. O. Nurmi, Sales Engrs.

Illinois Testing Labs., Inc.
Chicago, Ill. 237

Exhibiting: Pyrometer, resistance thermometers, velometers, thermo-anemometers, dew-pointers.

In Attendance: R. C. Chelius, W. J. Bailey, M. J. Rauscher, Sales Engineers.

Imperial Brass Manufacturing Co.
Chicago 7, Ill. 223

Exhibiting: New Flareless Steel Tube Fittings for high pressure service, for practically all types metal tubing; new Gear-Type tube benders for copper, brass, aluminum, steel tubing. Tube fittings, shut-off valves, tube working tools.

In Attendance: C. H. Benson, J. X. Allman, Keller Waugh, E. F. Todd.

Industrial Electronics, Inc.
Detroit 10, Mich. 230

Exhibiting: New "Dyna-Myke" Dynamic Micrometer indicates displacements of plus or minus ten micro-inches to plus or minus one inch from 0-800 cps, employs LVDT system with direct reading meter or scope jack; new "Cali-Bridge" contains 10 watt d-c power supply, 0-100 volts in five meter ranges, balancing and calibrating circuits for resistance bridges of 60 to 2000 ohms, output indicated by micro-ammeter or scope jack; new "Electro-Cal" low impedance, 10 watt, source of calibrated line voltage, six scale ranges, 1 mv to 100 volts, indicates directly on precision moving-vane type voltmeter. "Electro-Cal" calibrator, multiple power supply. Aging and selection of tubes, custom building of electronic gages for special industrial applications.

In Attendance: Dr. J. W. Head, Pres.; W. T. Bean, Director, Tech. Service Center.

Industrial Instruments, Inc.
Jersey City, N. J. 310

Exhibiting: New Indicator-Controller, continuous self-balancing solution conductivity; new chemical and heat resistant plastic conductivity cells; new pressure type conductivity cells for commercial sulfuric acid and oleum measurement; new Solu-Bridge and conductivity cell for measurement of resistance of ultra pure water. Solu-Bridge and Solu-Bridge Controllers.

In Attendance: Phillip M. Gotthold, V.P. and S.M.; Robert Rosenthal, Ch. Chemist.

Industrial Pyrometer & Supply Co.
Alton, Ill. 602

Exhibiting: Thermocouples; Thermocouple lead wires, wires, heads, insulators, protection tubes.

In Attendance. Avery L. Hack, Pres. & Gen. Mgr.; Franklin Hack, Asst. Gen. Mgr.; A. J. McBride, Engr. & Spec. Rep.

Institute of Radio Engineers
New York, N. Y. 127

Exhibiting: "Proceedings of the IRE", yearbook of Radio Engineers; Directory of Firms serving the Industry.

In Attendance: William C. Copp.

Instruments, Inc.
Tulsa, Okla. 314

Exhibiting: New Hydrogen Percentage Meter for percentage of hydrogen pressure in a line with other gases; new Fluid Piston Pump, mercury as pumping medium with only one moving part other than mercury in contact with liquid being pumped. "Gagetron"; F/C Pneumatic Transmitter; Pump Stroke Meter. Research and Development related to all types of industrial instrumentation.

In Attendance: O. W. Graham, Pres. & Dir. Research; Norman Paquin, Sales Rep.

Instrument Development Lab., Inc.
Needham Hts., Mass. 412

Exhibiting: New "Coloreye," Precision Computing Colorimeter for production color matching; Optimike. Laboratory facilities available for solution of complex problems on instrumentation and control for industry and the military services. Typical examples of development projects are included in the exhibit.

In Attendance: George P. Bently, Pres.; Edward P. Bentley, V.P.

Instruments Publishing Co.
Pittsburgh 12, Pa. 106

Exhibiting: "The Handbook of Measurement and Control" an informative digest of the new science of Instrumentation; "Instruments", the Magazine of Measurement and Control; "The Instruments Index", the Bi-annual Directory of the Instrument In-

dustry; "The Instrument Maker", the Trade Journal of the Instrument Industry; "The Instrument Maker Guide", the Bi-annual Directory of the Parts Manufacturers for the Instrument Industry. Books: "Scientific and Industrial Glass Blowing and Laboratory Techniques" by Barr & Anhorn; "Elementary Engineering Electronics" by Andrew Kramer; "Operation and Care of Circular Scale Instruments" by James Spencer.

In Attendance: Richard Rimbach, Publisher; M. F. Behar, Editor; C. F. Goldcamp, Sales Mgr.; Richard Rimbach, Jr., N. Y. Mgr.; W. J. Gallagher, Phila. Mgr.; H. W. Haskett, Chicago Mgr.

M. S. Jacobs & Associates
Pittsburgh 22, Pa. 212

Exhibiting: New Series 51, Forged Steel Hydraulic Non-Chatter Relief Valve; new Series 600 combination pressure and vacuum relief valve; new Pointer Draft Gage Alarm. Safety valves, relief valves, vacuum valves, pump by-pass valves, throttle valves, stainless steel specialties, straight line pointer diafram draft gages, inclined draft gages, inclined-vertical tube gages, U gages, air filter gages, satuator gages, Pitot tubes, U path steam calorimeter, portable gas analyzer Orsat type.

In Attendance. Mifflin S. Jacobs, Walter F. Gieryk, Robert B. Kerr, Richard Moses.

Jarrell-Ash Co.
Boston 16, Mass. 606

Exhibiting: New "Jaco" Recording Projection Comparator Microphotometer, photomultiplier-amplifier drives strip chart recorder. Miscellaneous scientific, optical, and Xray instruments for research and control. Consultation for laboratories contemplating spectrochemical equipment, technical assistance to existing spectrochemical labs.

In Attendance: Lynwood O. Eikrem, Fred F. Brech, Tech. Sales Reps.

J-B-T Instruments, Inc.
New Haven 8, Conn. 308

Exhibiting: New Sealed Vibrating Reed Frequency Meters, 3½" and 1½" sizes, 60—400 cycle combinations, used as working standard on panel; new Electronic Temperature Control. Vibrating reed frequency meters, pyrometers, appliance temperature testers, resistance thermometers, Shurite voltmeters, ammeters, milliammeters.

In Attendance: Carl J. Iaccarino, Dev. Engr.; Frank W. Taylor Sales Rep.; Roland M. Bixler, Gen. Mgr.

Jerguson Gage & Valve Co.
Somerville 45, Mass. 241

Exhibiting: New "Truscale" Remote Reading Level Indicator with secondary transmission to remote location; new TL-10 Series Liquid Level Gage with 2"ID for three-vision reading. Liquid level gages for all pressures to 20,000 lb.

In Attendance: James A. Ford, V.P.; E. E. van Ham, V.P.; Robert C. Stanley, Asst. Ch. Engr.; John Cox, Buffalo Rep.

H. C. Johnson Agencies
Rochester 20, N. Y. 432

Exhibiting: Sensitive and polarized relays (Sigma Instruments, Inc.) conventional types and a single pole multi-contact polarized relay available for mechanical latching units or with a 3-position armature arrangement; new Miniature Hydtrol Switch (Cook Electric) functions properly under 15 G's vibration 10-300 C.P.S.; new Cubic Inch Time Delay (Cook Electric); Precision Switches (Unimax Switch Div.) for high altitude work and hazardous locations, adjustable operating pressure and travel types for instrument work; Motors (Haydon Mfg. Co.) for chart drives and mechanisms.

In Attendance: Ralph W. Gage, Sales Engr., Sigma Instruments, Inc.; H. E. Varrelman, Mgr. East Div. Cook Electric Co.; Robert P. Aldrich, Ralph A. Biggar, Sales Agents.

Kay Electric Co.
Pine Brook, N. J. 404

Exhibiting: New Vibralyzer for producing Fourier Analysis of vibrations from 5 to 3000 cps, very narrow filter available, records in linear or logarithmic co-ordinates. "Rotalyzer", "Sona-Graph", "Sonalator".

In Attendance: H. R. Foster, Project Engr.; E. E. Crump, Executive Engr.; Frank G. Marble, Ch. Sales Engr.

Kieley & Mueller, Inc.
North Bergen, N. J. 407, 409

Exhibiting: Control valves and regulators.

In Attendance: Robert J. Donnelly, Sales Mgr.; Ward K. Stallings, Ch. Engr.; A. W. Bailey, Sales Engr.; Norman Lieblich, Sales Engr.

Lapp Insulator Co.,
Process Equipment Div.
Leroy, N. Y. 427

Exhibiting: New "Auto-Pneumatic" Pulsafeeder, a positive displacement diaphragm proportioning pump for handling liquid chemicals, changes output in response to instrument air pressure. Standard Pulsafeeder. Engineering on proportioning, metering, blending, sampling and pumping of most all liquid chemicals.

In Attendance: L. F. Wilson, Mgr. Pulsafeeder Div.; V. Leipold, Engr.; O. R. Lawrence, N. Y. State Engr.; H. Novak, Sales Engr.

Leslie Co.
Lyndhurst, N. J. 122, 124

Exhibiting: New Floatless Level Control, no torgue tubes or thermo elements, no bellows, no stuffing box, no plunger, no mechanical linkage, no floats. Reducing valves, pump governors, temperature and pressure controllers, air horns, steam whistles, self cleaning strainers.

In Attendance: R. W. Boettiger, A. J. Dromm, J. Bermingham, J. V. Tripoli, H. G. Jones, W. M. Wilson.

Lord Mfg. Co.
Erie, Pa. 426

Exhibiting: New Temproof Vibration-Control Mountings for base mounted electronic equipment; new Radiofocal Mounting Bases for aircraft electronic equipment conforming to Specification JAN-C-172A. Vibration-Control mountings for all purposes, flexible couplings 1/50 to 100 HP at 1750 RPM, custom made rubber-bonded-to-metal parts. Assistance in selecting and applying vibration-Control mountings.

In Attendance: Gordon Waite, R. M. Kilpartrick, Product & Sales Engrs.; P. E. Dailey, R. T. Dailey, C. L. Freel, Sales Div.

Magnetrol, Inc.
Chicago 23, Ill. 113

Exhibiting: New Flow Switch with adjustable flow rates for contact closing, for very low rates of flow; new A-150 Modulating Control for electrical positioning; new Air Pilot Valve. Liquid level controls. Consulting service on problems of liquid level control.

In Attendance: Lester E. Stybr, Sales Mgr.; Ben. L. Binford, Ch. Engr.; Dist. Reps.

Marine and Industrial Products Co.
Philadelphia, Pa. 212

Exhibiting: New Series 51, Forged Steel Hydraulic Non-Chatter Relief Valve for accurate control for pressure up to 4000 psig. New Series 600, Combination Pressure and Vacuum Relief Valve, presents overpressure or excessive vacuum for process vessels. Safety valves, relief valves, vacuum valves, pump by-pass valves, throttle valves, stainless steel specialties. For steam, water, air, gas, oil and all types of chemicals.

In Attendance: Joseph Schubert, Pres.; A. E. Fox, V.P.; F. J. Schubert, Sec.

Marion Electrical Instrument Co.
Manchester, N. H. 240

Exhibiting: New Ruggedized Hermetically Sealed Panel Type Instruments comply with Government specifications JAN-1-6 and Amendment 1. Hermetically sealed meters, bakelite cased meters, portable induction heating equipment. Engineering assistance to design meters to fit customers specifications.

In Attendance: R. A. Ammon, Gen. Mgr.; and Ch. Engr.; A. R. Tice, Project Engr.; E. E. Doherty, Wolfe, J. Marsey, Sales Engrs.

Mason-Neilan Regulator Co.
Boston 24, Mass. 418, 420, 422

Exhibiting: New 10000 Series Control Valves; new High Pressure Valves with angle and globe forged and cast steel bodies; new Combination Airset for instrument air supply; new Industrial Steam Reducing Valve internally pilot operated. Control valves, positioners, level controllers, reducing and back pressure regulators, pressure and temperature instruments, assembled panel boards.

In Attendance: F. Kenneth Morrison, V. P.; Ralph A. Rockwell, Dir. Engrg.; Thomas M. Nee, Mgr. Syracuse Dist.; A. Blair Powell, Mgr. Pittsburgh Dist.; Carl W. Gram, Mgr. N. Y. City Dist.

McAlear Manufacturing Co.
Chicago 8, Ill. 207

Exhibiting: New Diaphragm Motor Valves, full area body, shouldered seat rings, nested springs, ball bearing guided stem, leakproof, chemically inert seal, minimum stem friction; new Pressure Reducing Valve, self contained, metal diaphragm actuated, external pilot operated, spring not in path of steam flow; new Diaphragm Motor Valve for small flows, characterized valve plug, unusually wide rangeability, zero clearance flow; new Liquid Level Controller with pilot available with wide proportioning band, automatic reset, derivation action. Pressure reducing valves and temperature regulator. Regulation of pressures and flows of steam, air, water, gas or oil.

In Attendance: Wm. Ludvik, J. P. Henderson, G. F. Cook, W. Skoropad.

Meletron Corp.
Los Angeles 38, Calif. 214

Exhibiting: New Model 424 "Dualtrol" Switch will actuated two SPDT snap-action switching elements at any two independently adjustable set pressures; new Model 444 "Visco-trol" Pressure Actuated Switch designed to be operated by heavy liquids and powders in explosive atmospheres; new Model 450 Sanitary Pressure Actuated Switch for Food and Chemical processing industries requiring ready disassembly for cleaning to preserve sanitation; new Model 312 "Adjustable Actuation Valve" (differential) Pressure Actuated Switch. Pressure actuated switches, vacuum actuated switches.

In Attendance: George A. Starbird, Pres.; J. R. McDowell, Sales Engineer.

Meriam Instrument Co.
Cleveland 2, Ohio 315, 317

Exhibiting: New Portable Field Manometer; new and improved Manometers for measurement of pressures, vacuums and differentials; Manometers, draft gauges, mercury pressure gauges, tank gauges, indicating flow meters.

In Attendance: J. B. Meriam, Jr., Pres.; A. A. Hejduk, V.P.; Mark Meriam, Sales Engr.; R. H. Perry, Buffalo Rep.

Midwestern Geophysical Laboratory
Tulsa, Okla. 130

Exhibiting: New Galvanometers; new Laboratory, Medical, and Flight Test Oscillographs. Newly designed scientific and analytical instruments, oscillographs, galvanometers, amplifiers, accelerometers, strain gauges, velocity pickups. Repair service.

In Attendance: M. E. Morrow, Pres.; E. J. Handley, Exec. V.P.; G. R. Morrow, V.P.; W. E. Harrison, Ch Mech. Engr.; G. M. Downey, Supervisor Galvanometer Shop; M. F. Downey, Asst. Sup. Galvanometer Shop.

Milton Roy Co.
Philadelphia 18, Pa. 235

Exhibiting: New "mini Pump", miniature controlled volume pump for clear liquids in minute quantities at pressures up to 1000 psi; new Sanitary Pump for food processing and other applications requiring approved sanitary construction. Constametric pump; Titronic pump; Simplex pump with plastic liquid end.

In Attendance: Robert T. Sheen, Pres.; Willima T. Griffiths, Chem. Engr.; R. L. Schwartz, R. L. Schwartz, Jr., Buffalo Rep.

Miniature Precision Bearings
Keene, N. H. 117

Exhibiting: New Miniature Ball Bearings; new Ball Bearing Applications in Precision Instruments; new Complete Catalogue. Miniature precision ball bearings.

In Attendance: H. D. Gilbert, Pres.; W. S. Pierce, V.P. & Ch. Engr.; W. L. Timmerman, Eastern Service Man; Personnel from Syracuse Bearing Corp.

Mine Safety Appliances Co.
Pittsburgh 8, Pa. 302, 304

Exhibiting: New Electrostatic Sampler. Combustible gas and carbon monoxide detectors, indicators and recorders; "Lira" infra-red analyzer; variety of gas detectors; Nitrogen, benzol, hydrogen sulfide, etc.

In Attendance: N. W. Hartz, Prod. Line Mgr.; John Sherwin, Instrument Sales Engr.; J. S. Hartz, L. E. Fancourt, Sales Engrs.; John Gray, R. W. Keaton, Industrial Sales Dept.

Moore Products Co.
Philadelphia 24, Pa. 435, 437

Exhibiting: New H/p Differential Pressure Transmitter, a bellow-type flow meter for high-pressure applications; new H/p

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Flow Transmitter-Controller, a combination of the H /p differential pressure Transmitter and a remote-set type Nullmatic controller; new Motion Transmitter, pilot-operated unit which maintains the inherent accuracy of the measuring element; new Nullmatic M /F Relay receive one, two or three loading pressures and use a pneumatic force-balance system to transmit a single modified pressure which can include totalizing, differential, inverting, amplifying, derivative, and other functions; new Pneumatic Precision Relay, for operating air-electric switches and similar equipment. Nullmatic M /P control station, Nullmatic Controller (remote-set type) with integral cut-off relay, Nullmatic inverse derivative unit, built-in valve positioner, liquid level controller (packless flexible shaft type), Nullmatic thermometer, Nullmatic remote manual control station.

In Attendance: Chas. H. Thompson, Sales Mgr.; J. E. Gambrill, Mgr. Detroit Office; J. J. Fregeau, Mgr. Chicago Office; H. S. Garrett, Mgr. Application Engr.; H. Dean Valentine, Sales Engr.; R. H. Owens, Sales Engr.

National Bureau of Standards
Washington, D. C. 617

Exhibiting: Rapid reversal motor; Micromanometer with metal diaphragm electronic pickup; Spiral contractometer for measuring stress in electro deposits; Radio activity standards.

In Attendance: V. H. Dibeler; D. S. Goalwin; C. L. Bragaw.

Nash Engineering Co.
South Norwalk, Conn. 401, 403

Exhibiting: New Model Instrument Air Compressor designed to furnish absolutely clean air, without dust, heat or oil. Clean air brand compressors, Operating exhibit demonstrating new model compressor.

In Attendance: Irving C. Jennings, Pres.; Edward A. Mead, V.P. & S.M.; H. E. Adams, Ch. Engr.; W. M. Thompson, Ass't. Sales Mgr., Airborne Equip.; J. B. Wright, Ass't. Sales Mgr., Building Equip.; F. W. Green, Ass't. Sales Mgr., Industrial Equip.; E. A. Barton, Robert S. Perew, Sales Engrs.; George B. Wright, Publicity Mgr.

Nestor Engineering Co.
Teaneck, N. J. 324

Exhibiting: New Automatic Motor Control, starts Teleprinter motor automatically; new Network Single Line Repeater, amplifies and repeats signals of weak order received from East Line and West Line; new Electronic Combination Duplex Telegraph Terminal may be used as full duplex or as half-duplex telegraph terminal; new Direct Current Power Supply plugs into A.C. power supply and furnishes low ripple D.C. to replace local battery. Complete engineering consultant service to the field of railroad communications.

In Attendance: Wm. A. Manty, Gen. Mgr.

New Hermes Engraving Mach. Corp.
New York 3, N. Y. 224

Exhibiting: New Engravograph Engraving Mach. for all metals, plastics, wood, etc., three models; Model H, Bench type, Model IT, large portable, Model IM, small portable. Complete maintenance department.

In Attendance: Messrs. Shimmel, Jaffe, Kaufman.

New York State Institute of Applied Arts and Sciences
Buffalo, N. Y. 607

Exhibiting: Two year Terminal Education; Mechanical (Instrumentation), Metallurgial, Electrical, Building Construction, Chemistry, Optical, Food Administration, Dental Hygiene.

In Attendance: Otto V. Guenther, Ernest Starkweather, Jack Mahar, Ralph Ross, Edward Fix, Alec Armsden, Edward McDonough, James Shenton.

Palmer Thermometers, Inc.
Cincinnati 12, Ohio 319, 321

Exhibiting: New 4½" Mercury Actuated Dial can be adjusted to most readable position at any angle, interchangeable with Palmer industrial type sockets. Thermometers, industrial indicating type.

In Attendance: Bartlett Palmer, Pres.; Frank Probst, Douglass Hitt, Sales Reps.

Panellit Inc.
Chicago 26, Ill. 201, 203, 205

Exhibiting: New Signalling Devices Series 400 Annunciators for hazardous and corrosive atmospheric locations; new Illuminated Pneumatic Level Indicating Receivers Model 240 for direct reading of levels at remote points, operates from any 3-15 lb. transmitter. Prefabricated instrument and control panels; Panalarm annunciators; Illuminated indicating receivers. Prefabricating, piping and wiring of instrument and control panels.

In Attendance: Albert F. Sperry, Pres.; Marvin S. Lorig, Ch. Engr.; R. E. Anderson, Oscar Ackerlund, Robert Cleveland, Engrs.; N. N. Tigerman, Adv. Mgr.; J. S. Leviton, Mgr.

Panoramic Radio Products, Inc.
Mount Vernon, N. Y. 428

Exhibiting: Model AP-1, Sonic Analyzer; Model SB-7, Ultrasonic Analyzer.

In Attendance: Robert Augustine, Engr.

Penberthy Injector Co.
Detroit, Mich. 430

Exhibiting: New Reflex and Transparent Gages for pressures of 10000 lbs. and up. Water and liquid level gages and gage valves made of iron, brass, drop forged steel, stainless steel and other special alloys.

Penn Industrial Instrument Corp.
Philadelphia 32, Pa. 221

Exhibiting: New Flow Controller & Transmitter, pneumatic control or transmitter with friction-free Flow Meter utilizing magnetic coupling; new Long Distance Telephone Line Transmission for any measured function over unlimited distances; new Temperature and Pressure Controllers, on-off, proportional, derivative, and automatic reset actions; new "Linameter" Flow Rate Transmitter. Electric and electronic flow meters, variable area "Linameter" type flow meters, temperature, pressure and level recorders, pneumatic controls and transmitters, electric alarms.

In Attendance: Wm. C. Bennett, Pres.; Wm. Melas, Ch. Engr.; James W. Bennett, Gen. Sales Mgr.; George D. Keller, Mgr. Sales Engrg. Dept.; E. Ross Forman, Sales Dept.; W. L. Applegate, Service Dept.

Permutit Co.
New York, N. Y 226

Exhibiting: New Ranarex Equipment with remote indicating, recording and controlling device. Ranarex — for the measurement of gases by Specific Gravity.

In Attendance: F. D. Harger; F. B. Leslie; B. Conaty; H. G. Brown.

Photoswitch, Inc.
Cambridge 42, Mass. 311, 313

Exhibiting: New Smoke Density Indicator and alarm control provides a visible ringlemann indication and preset alarm point, remote light source and scanner with indicator-controller in boiler room. Photoelectric controls; Liquid level controls; Electronic timers.

In Attendance: John A. Long, Exec. V.P.; O. C. Stark, Gen. Sales Mgr.; T. A. McCollum, Midwest Sales Mgr.; J. P. Steinman, New England Sales Mgr.; J. B. Sullivan, Factory Sales.

Physicist Research Co.
Ann Arbor, Mich. 121, 123, 125

Exhibiting: Profilometer Equipment: Tracers, Amplimeters, Rotary Pilotor, Linear Pilotors, Mototrace and Reading Recorder. Demonstration of equipment for surface roughness measurement.

In Attendance: Ernest J. Abbott, Pres. & Mgr.; Frank W. Kabat, Head Field Rep.; Arnold W. Loyd, Field Rep.; George Haber, Jr., Field Rep.; Wm. R. Frakes, Prod. Engr.

Precision Thermometer & Instrument Co.
Philadelphia 30, Pa. 202

Exhibiting: New "Densitrol" continuous liquid density measuring equipment for high pressure and severe industrial service; new "Densitrol" direct reading specific gravity testers for continuous flow or intermittent sampling. Thermometers, hydrometers, barometers, mercurial thermostats (laboratory and industrial) manometers, hygrometers, mercurial vacuum and pressure gages.

In Attendance: C. H. Waser; J. C. Boonshaft, W. D. Laverell.

Proportioneers, Inc.
Providence 1, R. I. 218

Exhibiting: New Midget Dual Loss-In-Weight unit for automatic gravimetric feed and reload for high accuracy small capacity liquids or gases. New small multiple component liquid blender for continuously controlling from 2-6 simultaneous streams. Chem-O-Feeder, Adjust-O-Feeder, Treet-O-Unit. Engineering service on proportioning and chemical handling problems.

In Attendance: R. P. Lowe, P. V. Crowther, E. M. Sergeant, W. R. Landis.

Rochester Manufacturing Co.
Rochester, N. Y. 424

Exhibiting: Two New Industrial Thermometers, one including a calibration reset mechanism at rear of dial housing, the other a solid, one piece thermometer stem and nut, pressure tight to 2000 lbs. without wells or sockets. New Gauge and Liquid Level Control, dial type indicator with controller through pump motor controlling low and high level in vented or pressure type vessels. Liquid level, pressure and temperature gauges.

In Attendance: Clark L. Hastings, V.P. Sales; Ralph Foster, Thermometer Sales Div.; Dave McEwen, Asst. Sales Mgr.

Rockwell Manufacturing Co.
Pittsburgh 8, Pa. 408

Exhibiting: New Midget Chart Drives for instruments where space is at a premium. Gas meters, gas pressure regulators, water meters, gasoline and oil regulators and valves.

In Attendance: J. L. Cottrell, Mgr. Integrator & Orifice Meter Div.; Earl Mowrey, Service Engr.; E. V. Bishoff, Ray Jerges, J. Perry, Sales Reps.

R-S Products Corp.
Philadelphia 44, Pa. 419, 421

Exhibiting: Butterfly Valves, Duplex Strainers, Heyden Shock Absorbers, Leveltronic Control.

In Attendance: R. C. Ayers, Sales Mgr.; D. C. Culver, R. W. Crane, L. T. Brodie, E. S. Stem, W. B. Parsons, H. A. Schlieder, Linwood Kimball, J. H. Spurgeon.

Sanborn Co.
Cambridge 39, Mass. 216

Exhibiting: Several Models, single and multichannel, of Direct-Writing Recorders, featuring permanent records, made without ink and having true rectangular co-ordinates; also interchangeable driver amplifiers of DC, Strain Gage, and other types.

In Attendance: Walter H. Crane.

Servo Corporation of America
New Hyde Park, L. I., N. Y. ...402

Exhibiting: New "Servotherm" Thermistor Bolometers & Electrical Accessories, infrared detectors for spectrophotometric industrial and military applications; "Servotherm" Preamplifiers for use in conjunction with bolometers; new "Servo-scope" for measuring frequency response of servomechanism components & systems; new "Servoboard" set of standard parts including gears, shafts, bearings, hangers & mounting plates which, when coupled to necessary motors, tachometers, synchros, potentiometers & amplifiers builds a flexible developmental assembly of the servo system, computer or regulator.

In Attendance: Henry Blackstone, Pres.; Sabert N. Howell, Eric Wormser, Staff Engrs.; Wm. Derganc, Dev. Engr.

Shand and Jurs Co.
Berkeley 10, Calif. 323

Exhibiting: New Electronic Remote Reading Automatic Tank Gauge System, for gauging liquid depths from a remote point. Remote reading gauge system, Selsyn Motor type.

In Attendance: Ralph F. Ley, Mgr. Eastern Div.; Joseph T. Drumm, Asst. Mgr. Eastern Div.; Robert W. Blake, Mgr. Chicago; Herbert M. Durlam, Asst. Mgr. Chicago.

Sharples Corp.
Philadelphia 40, Pa. 509

Exhibiting: Sharples Micromerograph, for rapid, continuous particle size distribution determinations over broad range of fine-sieve and sub-sieve powders by gaseous sedimentation. Lab super-centrifuge.

In Attendance: Allen S. Dunn, Administrator & Sales; Wm. J. Poehlmann, Mech. Engr.; Robert E. McCarter, Engr.

Ivan Sorvall, Inc.
New York 10, N. Y 128

Exhibiting: New Blum Liquid Tachometer, indicates the instantaneous speed of a rotating object by the lengthening of an air bubble contained in a viscous transparent fluid; new Servall Electronic Tachometer for instantaneous speed reading by unit

applied to rotating object, a magnetic-type generator, and an electronic-type analyzer; new Servall Magnetic Stirrer. Original-Odhner Calculators; Angle Centrifuges, superspeed and vacuum operated; Automatic and hand pipetting machines.

In Attendance: Jack H. Anderson, Torsten Soderlund, Sales Reps.

Standard Electric Time Co.
Springfield, Mass. 335

Exhibiting: Timers; Chronotachometers; Custom-built voltage distribution and test panels; Clock-systems; Hospital Nurses calling and Doctors paging systems.

In Attendance: E. S. White, Asst. Sales Mgr. S. C. Jordan, Field Engr.

Statham Laboratories, Inc.
Los Angeles, Calif. 130

Exhibiting: Strain gauges; Transducers; Pressure pick ups; Accelerometers; Laboratory type temperature control ovens, etc.

In Attendance: Engineering Personnel, Midwestern Geophysical Laboratory.

Herman H. Sticht Co.
New York 7, N. Y. 322

Exhibiting: New Model 29, Twenty Million Megohmmeter, electronic, for ultra high resistance measurements, test potential 85V, DC and 500V, D.C., ranges from 300,000 ohms to 2,000,000 megohms split in 6 decades at 85V, ranges 30 megohms to 20,000,000 megohms split in 5 decades at 500V; new Chronotest Electronic Millisecond Timer for measuring elapsed time with ranges as low as 0-40 microsecond and as high as 10 seconds. Megohmer insulation testers (battery vibratory and DC generator types); tachometers (portable and stationary, centrifugal and chronometric types); stop watches; slide wire rheostats.

In Attendance: A. H. Volker, Sales Mgr.; Robert Sticht, Frank Dugan, D. K. Cooper, Mr. Morgan, Sales Engrs.

Streeter-Amet Co.
Chicago 13, Ill. 320

Exhibiting: New Model SCI-15 recording counter prints on card or ticket. Scientific & industrial recording counters; Traficounters, Model RC, Model JR, Model PSI.

In Attendance: V. C. Kennedy, Jr., Supvr. of Engineering; Paul Becher, Prod. Foreman; J. H. Minor, Sales Rep.

Superior Tube Co.
Norristown, Pa. 115

Exhibiting: New Weldrawn Titanium Tubing in sizes ⅜" O.D.x.049" wall to ⅛" O.D. x.010" wall. Seamless and Weldrawn round shaped tubing in carbon, alloy and stainless steels, nickel alloy and Beryllium Copper. Smallest tube in World on exhibit.

In Attendance: M. P. Moffitt, C. G. Cope, Tubing Specialists; W. O. Nussehr, Jr., Sales.

Surprenant Mfg. Co.
Boston 8, Mass. 126

Exhibiting: New Plastic Tile; new Coaxial Cables; Wire and Cable Plastic; Multi-Conductor Cables; Plastic Tubing.

In Attendance: George Forsberg, Prod. Mgr., V.P.; Donald Alexander, Elect. Engr.; Eli Berube, Asst. Supervisor; Albert H. Surprenant, Pres.; Richard Surprenant, Salesman.

Taber Instrument Co.
North Tonawanda, N. Y. 326

Exhibiting: New Abraser Model 140, standard abrasion testing set. Abraser Model E-4010 testing set; V-5 stiffness gauge.

In Attendance: R. F. Taber, L. S. Barker.

Telechron, Inc.
Ashland, Mass. 119

Exhibiting: New H7 Synchronous Timing Motor (1, 2, 3, 4, & 6 r.p.h.); new C73 one minute to four hour clock and signal timer. Synchronous timing motors and instrument movements.

In Attendance: W. F. Greenwood, Ind. Sales Mgr.; C. B. Dix, Motor Sales Mgr.; F. T. Bees, J. H. MacLeod, R. H. LeShane, Sales Engrs.; R. E. Zucker, Motor Sales Supervisor.

Trimount Instrument Co.
Chicago 23, Ill. 208

Exhibiting: Manometers; Flow Meters; Smoke Indicators; Draft Gauges; Level Controls; Tank Gauges; Micromanometers.

In Attendance: R. I. Robin, Pres.; J. R. Christenson, Engr.; M. S. Jacobs, A. Wiess, Sales.

H. O. Trerice Co.
Detroit 16, Mich. 220

Exhibiting: New No. OX Standard Trap and OXB Blast Trap; new Thermal Unit for all Blast Traps eliminates possibility of air binding; new Indicating Self Operating Temperature Regulator. Industrial, laboratory, dial and recording thermometers, temperature and pressure regulators, pressure gauges, steam traps, air filters, air guns. Complete repair service on temperature and pressure instruments.

In Attendance: H. O. Trerice, Pres.; J. L. Brackett, Sales Mgr.; F. Z. Dahn, Asst. Sales Mgr.; E. L. Myers, Ch. Engr.; H. E. Rieckelman, Buffalo Rep.; R. L. Springer, Buffalo Sales.

Uehling Instrument Co.
Paterson, N. J. 507

Exhibiting: Absolute Pressure Indicators and Recorders; Liquid Level Indicators; Vacuum Indicators; Pressure Gauges; Pressure and Vacuum Gauges, Draft Gauges; Mercurial Barometers; Vacuum Recorders; Manometers.

In Attendance: C. J. Schmid, Alexander Foth, Sales Engrs.; P. J. Riccobene, Sales Mgr.; Wm. Justice, Pgh. Rep.; R. C. Chelius, Buffalo Rep.

U. S. Air Material Command
Dayton, Ohio 608

United States Gauge, Div. American Machine and Metals Inc.
Sellersville, Pa. 340, 342

Exhibiting: New Pressure Gauges and Thermometers, single and duplex, internally-illuminated, for diesel-locomotive and general-panel mounting; new Standard Test Gauges, 16", with integral parallax mirror providing 40" to 45" custom-calibrated scale, new Protected Gauges, extreme high pressure up to 15,000 pounds per chemical and mechanical research; new Hermetically Sealed Transmitters and Receivers for remote indication of torque pressure, fuel, oil, etc. for temperature extremes in aircraft applications. Protected and cleanout type chemical gauges; Electric Transformer pressure gauge; Low range absolute pressure gauge; General purpose, welding boiler and household heating gauges and thermometers; Pressure alarm switches; Industrial Thermometers.

In Attendance: I. Newton Becker, V.P. and Gen. Mgr.; A. E. LeVan, Dir. Sales and Engrg.; Charles A. Frank, Jr., Gen. Sales Mgr.; P. W. Harland, Ch. Prod. Research; J. S. Hursh, Buffalo Dist. Sales Rep.

U. S. Navy Dept.
Washington, D. C. .....700 to 714

Exhibiting: Electronic equipment; Ordnance equipment; Naval Research Laboratory equipment; Ordnance Laboratory equipment; Applied Physics Laboratory equipment.

In Attendance: S. Gustof, Bureau Ships; Bernice Winter, Bureau Ordnance; W. J. Mayo-Wells, Applied Physics Lab.; R. Miller, Bureau Ordnance Lab.; Mr. Lister, Naval Research Lab.

Vapor Recovery Systems Co.
Compton, Calif. 329

Exhibiting: New "Varec" Electronic Gauger Receiver No. 812R for remote liquid level indication; new "Hi-Lo" Level Alarms for electronic gauger installed in conjunction with receiver; new "Varec" Remote Reading Average Liquid-Temperature Indicator. "Varec" electronic gauger. Installation supervision, annual or biennial factory routine service check.

In Attendance: Theo Meadows, N. Y. Dist. Mgr.; J. E. White, Jr., Sales Engr.; J. R. Edwards, Sr. Pgh. Sales Office; J. R. Edwards, Jr., Sales Engr.

Veeder-Root, Inc.
Hartford 2, Conn. 505

Exhibiting: Electrically and mechanically operated counting devices, featuring those models particularly adapted for instrument field.

In Attendance: A. E. Kallinich, V.P.; G. L. Logan, Div. Sales Supvr.; W. R. Soderquist, Sales Engr.; D. Addison, Sales Rep.

Wallace & Tiernan Products, Inc.
Belleville 9, N. J. 307

Exhibiting: Absolute pressure indicators and controllers, dial manometers, aneroid barometers, low pressure gages.

In Attendance: Warren F. Haring, Mgr. Instrument Sales; Lester E. Demler, Sales Engr.

Weatherhead Co.
Cleveland 8, Ohio 330, 332

Exhibiting: New Hose and Resuable Hose Ends, all steel resuable hose ends, positive leakproof connections, maximum flow, complete line all sizes and pressures. Industrial tube and pipe fittings (inverted, compression, S.A.E., 37 degree flare, threaded sleeve and pipe), Ermeto steel and stainless steel fittings.

In Attendance: A. D. Hodge, Sales Mgr., Ind. Div.; J. R. Holiger, Sales Rep.; A. J. Culbert, Asst. Sales Mgr.; B. H. Booms, Asst. to Sales Mgr.; J. G. Guardiola, Adv. Mgr.; W. J. Tomko, Adv. Dept.; T. Pasco, Service Engr.

W. M. Welch Mfg. Co.
Chicago 10, Ill. 232

Exhibiting: New Densichron Densitometer reading densities to 4 and foot candles from 0.005 to 5. Blue or red sensitive photo tubes, voltage controlled light box for transmission work, voltage controlled reflection head for reflection densities available. Electrical measuring instruments, duo seal vacuum pumps, laboratory balances.

In Attendance: R. C. Hoffman, C. R. Williams, J. Gutsmeidl, G. Flemming.

Weston Electrical Instrument Corp.
Newark 5, N. J. 227, 229

Exhibiting: Electrical Measuring Instruments; Relays; Electric Tachometers; Thermometers; Pyrometers, indicating, controlling, recording; Speed Radio Tachometers; Specialized Testing Equipment; Service Equipment.

In Attendance: E. R. Manning, Sales Engr.; A. G. Koenig, Gen. Sales Mgr.; E. T. Higgons, Mgr. Communications & Electronic Sales; L. Van Blerkom, Asst. Gen. Sales Mgr.; D. K. Cooper, Dist. Rep.; E. T. Oettinger, Div. Sales Mgr.; C. J. Morgan, Dist. Rep.

Wheelco Instruments Co.
Chicago 7, Ill. 217

Exhibiting: New small indicating Pyrometer for limited space requirements; new Pneumatic Capacilog Strip Chart Recorder using "Electronic Link" to connect electrical measuring system and pneumatic control system. Flame-otrol, Capacitrol, Capacilog, Chronotrol, Portable Pyrometers, Resistance Thermometers.

In Attendance: C. A. Gates, V.P. & Eastern Div. Mgr.; R. A. Schoenfield, V.P. & Western Div. Mgr.; Chas. L. Saunders, Exec. V.P.; W. J. Olson, Buffalo Dist. Mgr.; J. P. Cantor, Cleveland Dist. Mgr.

Will Corp.
New York, N. Y.; Rochester, N. Y.; Baltimore, Md. 612

Exhibiting: Beckman automatic titrator; Model H-2 Beckman pH meter with swing type electrode assembly; Micro torsion balance; Multiple unit muffle furnace with built in controls; Model SM-1 semi-micro projection balance; "Kamatic" hot plate and safety beaker holder.

In Attendance: B. C. Smith, Gen. S. M.; A. Chmiel, Mgr. Buffalo Apparatus Corp.; R. J. Bott, Tech. Dir.; R. Scott, W. Deach, Technical Dept.; M. Lynch, A. Campfield, Buffalo Sales Reps.

Yarnall-Waring Co.
Philadelphia 18, Pa. 132

Exhibiting: New Low-pressure Hi-Lo Water Column with vertical gage and try-cock. Operating display panel showing water level indicator and water level recorder connected to and operated from water column and gage. Automatic control unit for indicator and recorder, operating remote hi-lo alarm signal light and horn.

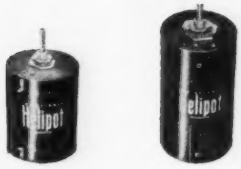
In Attendance: Carl Liberg, Buffalo Sales Representative.

UNIVERSITY OF MICHIGAN LIBRARIES

In this panel are illustrated standard models of HELIPOT multi-turn and single-turn precision potentiometers—available in a wide range of resistances and accuracies to fulfill the needs of nearly any potentiometer application. The Beckman DUODIAL is furnished in two designs and four turns-ratios, to add to the usefulness of the HELIPOT by permitting easy and rapid reading or adjustment.

A B C

MODELS A, B, & C HELIPOTS
A—10 turns, 46" coil, 1-13/16" dia., 5 watts—resistances from 10 to 300,000 ohms.
B—15 turns, 140" coil, 3-5/16" dia., 10 watts—resistances from 50 to 500,000 ohms.
C—3 turns, 13-1/2" coil, 1-13/16" dia., 3 watts—resistances from 5 to 50,000 ohms.



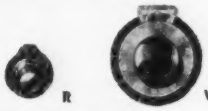
D E

MODELS D AND E HELIPOTS
Provide extreme accuracy of control and adjustment, with 9,000 and 14,400 degrees of shaft rotation.
D—25 turns, 234" coil, 3-5/16" dia., 15 watts—resistances from 100 to 750,000 ohms.
E—40 turns, 373" coil, 3-5/16" dia., 20 watts—resistances from 200 ohms to one megohm.

F G

MODELS F AND G PRECISION SINGLE-TURN POTENTIOMETERS
Feature both continuous and limited mechanical rotation, with maximum effective electrical rotation. Versatility of designs permit a wide variety of special features.
F—3-5/16" dia., 5 watts, electrical rotation 359°—resistances 10 to 100,000 ohms.
G—1-5/16" dia., 2 watts, electrical rotation 356°—resistances 5 to 20,000 ohms.

LABORATORY MODEL HELIPOT
The ideal resistance unit for use in laboratory and experimental applications. Also helpful in calibrating and checking test equipment. Combines high accuracy and wide range of 10-turn HELIPOT with precision adjustability of DUODIAL. Available in eight stock resistance values from 100 to 100,000 ohms, and other values on special order.



R W

MODELS R AND W DUODIALS
Each model available in standard turns-ratios of 10, 15, 25 and 40 to 1. Inner scale indicates angular position of HELIPOT sliding contact, and outer scale the helical turn on which it is located. Can be driven from knob or shaft end.
R—2" diameter, exclusive of index.
W—4-3 4" diameter, exclusive of index. Features finger hole in knob to speed rotation.

FOR PRECISION POTENTIOMETERS come to Helipot

For many years The HELIPOT Corporation has been a leader in the development of advanced types of potentiometers. It pioneered the *helical* potentiometer—the potentiometer now so widely used in computer circuits, radar equipment, aviation devices and other military and industrial applications. It pioneered the DUODIAL*—the turns-indicating dial that greatly simplifies the control of multiple-turn potentiometers and other similar devices. And it has also pioneered in the development of many other unique potentiometric advancements where highest skill coupled with ability to mass-produce to close tolerances have been imperative.

In order to meet rigid government specifications on these developments—and at the same time produce them economically—HELIPOT* has perfected unique manufacturing facilities, including high speed machines capable of winding extreme lengths of resistance elements employing wire even less than .001" diameter. These winding machines are further supplemented by special testing facilities and potentiometer "know-how" unsurpassed in the industry.

So if you have a problem requiring *precision potentiometers* your best bet is to bring it to The HELIPOT Corporation. A call or letter outlining your problem will receive immediate attention!

Trade Marks Registered

The versatility of the potentiometer designs illustrated above permit a wide variety of modifications and features, including double shaft extensions, ganged assemblies, the addition of a multiplicity of taps, variation of both electrical and mechanical rotation, special shafts and mounting bushings, high and low temperature operation, and close tolerances on both resistance and linearity. Examples of potentiometers modified for unusual applications are pictured at right.

A C

3-GANGED MODEL A HELIPOT AND DOUBLE SHAFT MODEL C HELIPOT
All HELIPOTS, and the Model F Potentiometer, can be furnished with shaft extensions and mounting bushings at each end to facilitate coupling to other equipment.
The Model F, and the A, B, and C HELIPOTS are available in multiple assemblies, ganged at the factory on common shafts, for the control of associated circuits.

B F

MULTITAPPED MODEL B HELIPOT AND 6-GANGED TAPPED MODEL F
This Model B Helipot contains 40 taps, placed as required at specified points on coil. The Six-Gang Model F Potentiometer contains 19 additional taps on the middle two sections. Such taps permit use of padding resistors to create desired non-linear potentiometer functions, with advantage of flexibility, in that curves can be altered as required.

THE Helipot CORPORATION, SOUTH PASADENA 11, CALIFORNIA

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SUPER-SENSITIVE CONTROL WITH...

The Brown Remote Indexet

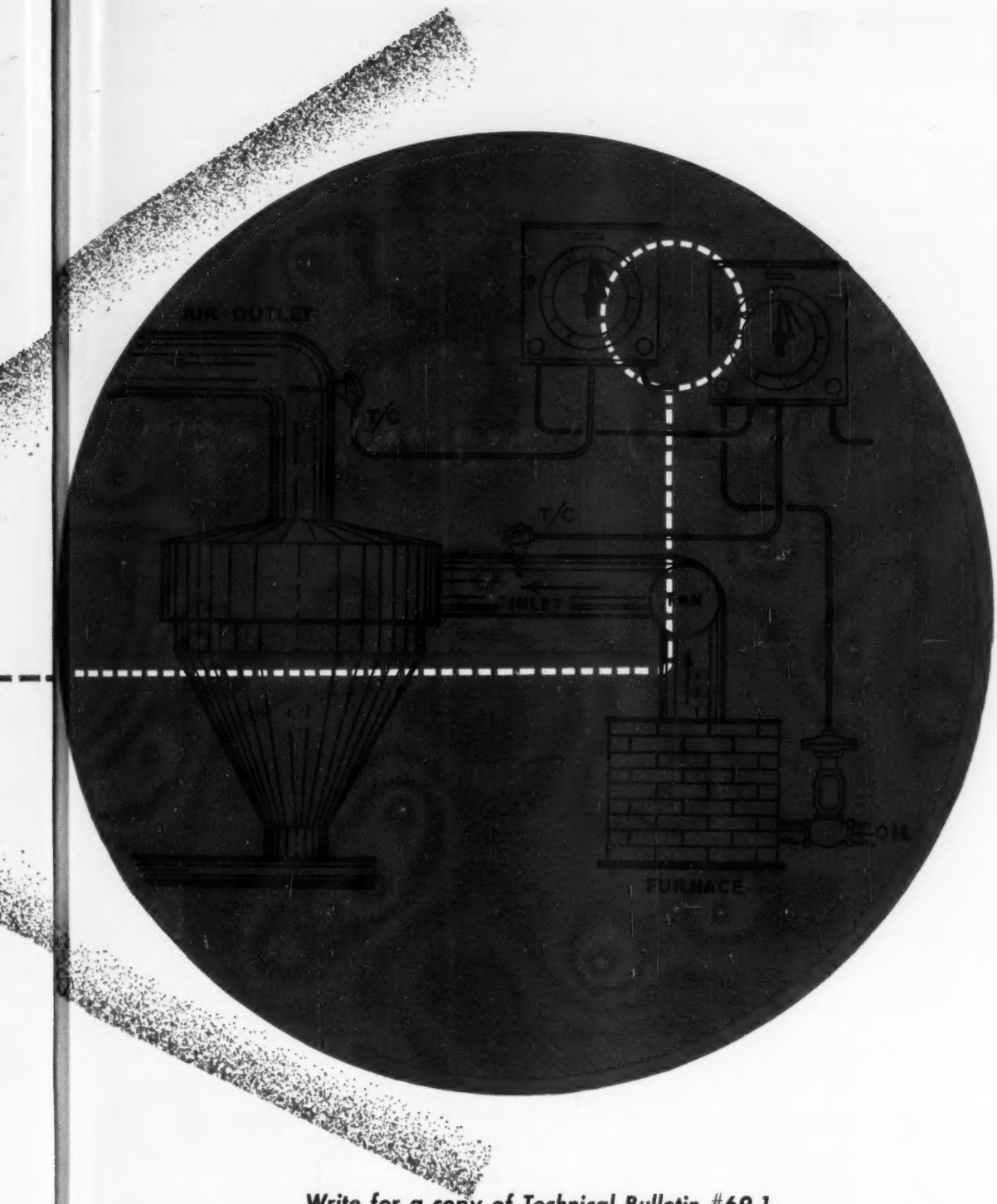
THE Brown Remote Indexet affords a positive way to a new high in sensitivity and accuracy of control action . . . meeting the unusual demands of many types of advanced process equipment.

Typical is its application to the control of the drying chamber in a spray drying unit for distillers solubles. Here, the outlet temperature controller sets the index of the secondary instrument, whose thermocouple is inserted in the inlet air duct. The secondary instrument actuates a control valve on the oil flow to the furnace.

With the use of these controllers interconnected by means of the Remote Indexet, the inlet temperature controller compensates for the undesirable process characteristics of heat transfer in the furnace while the outlet temperature controller compensates for the process characteristics of the drying chamber.

The result is super-sensitive cascade control, with rapid response to variations in operating conditions.

For full particulars on the use of the Remote Indexet for your particular process, call in your local Honeywell engineer . . . he is as near as your phone. MINNEAPOLIS-HONEYWELL REGULATOR CO., *Industrial Division*, 4482 Wayne Ave., Philadelphia 44, Pa. Offices in more than 80 principal cities of the United States, Canada and throughout the world.



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FOR BETTER PROCESSING

MINNEAPOLIS
Honeywell
BROWN INSTRUMENTS

The Month's NEW INSTRUMENTS

In this department we report each month new devices for measurement, inspection, testing, metering and automatic control — in the form of concise technical descriptions.

FOR FURTHER INFORMATION USE THE POSTAGE-FREE ORDER CARD ON PAGE 863

UNIVERSITY OF MICHIGAN LIBRARIES

Ultra-high-vacuum Gage

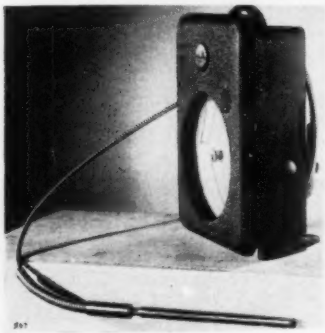
New ionization-type vacuum gage measures pressures as low as 5 billionths of a micron of mercury. It has usual three elements—filament, grid, and ion collector—but these are inverted from usual arrangement. Two

filaments are outside cylindrical grid; and "plate" (consisting of a fine wire) is suspended within grid. Volume thus enclosed by grid is comparable to that between grid and plate of conventional ionization gage. Minimization of metallic surface facilitates outgassing by electron bombardment at temperatures above 1000 C. with power less than 100 watts. Hard-glass enclosure is 2 in. diam., 5 in. high. New gage can be operated on standard power supplies and will be furnished with special tubulation for direct reading to various types of glass systems.—*Electronic Tube Sales, Westinghouse Lamp Div., Bloomfield, N. J.*

Mention No. 901 when filling out card.

Small Convertible Recorder

New 6 in. recorder measures 8.375 in. x 10.625 in. x 3.75 in., and weighs 7.5 lbs., not including tubing. Temperature and pressure systems of recorder are

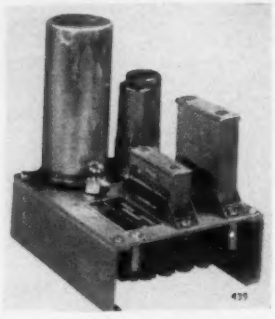


interchangeable and case may be flush or wall mounted. Legs and handle are available to make recorder portable. Temperature ranges cover from minus 40 to 1000 F. (or equivalent C.) ; pressure ranges cover from 0 to 5000 psi. Thermal systems supplied are mercury, gas or vapor pressure, according to use. Size of bulb depends upon filling and length of tubing actuated. Various constructions are available for bulbs, movements, capillary tubes & protective armor. Standard finish is black crinkle, though a smooth black finish may be specified.—*Gotham Instruments Div., American Machine and Metals, Inc.*, 149 *Wooster St., New York* 12, *N. Y.*

Mention No. 902 when filling out card.

Frequency Standard

New "Type 2001-2" tuning-fork frequency standard covers range between 200 and 1500 cps. with dividers and multipliers available for other frequen-



cies. Accuracy is 1 part in 100,000 with a temperature coefficient of better than 1 part per million per degree from 0 to 85 C. Unit operates from 6, 12, or 28 v., d.c. at 3.6 watts, and 100 to 350 v., d.c. at 0.008 amp.—*American Time Products, Inc.*, 580—*5th Ave., New York* 19, *N. Y.*

Mention No. 903 when filling out card.

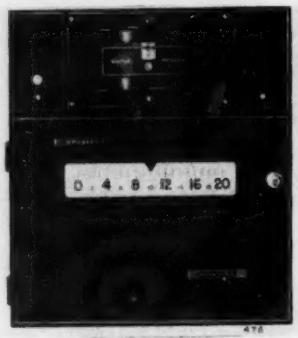
Molten-steel Thermocouple

New immersion thermocouple for measuring temperature of molten steel will be supplied in two forms. One will have a 90-degree bend for electric furnaces, the other a 60-degree bend for easy insertion through open-hearth wickets. Both forms have six-foot handles. Immersion end, excepting tip, is covered with a refractory compound. Assembly is about 11 ft. long and weighs approx. 40 lbs. Platinum thermocouple wires extend from extension wire at handle, through tubing, to thermocouple tip.—*Brown Instruments Div., Minneapolis-Honeywell Regulator Co., Philadelphia, Penna.*

Mention No. 904 when filling out card.

Potentiometer Controller

New "Potentiotrol" adapts manufacturer's "Electronic Link" to potentiometer controllers. Primary elements suitable include thermocouples, radiation detectors, and resistance bulbs. Instrument uses null type measuring system

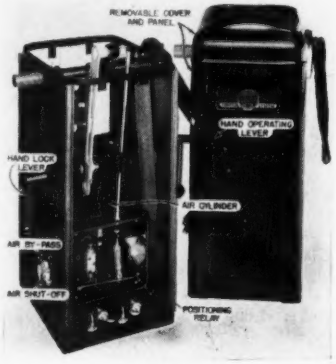


and is available with suppressed ranges. Control point setting knob also positions slide-wire contact, developing an emf. which opposes thermocouple. At balance point, electronic circuit deenergizes control relay. Means are provided for standardizing circuit. Operating voltage selector plug is included in all models, and vibration mounting kit and thermocouple break protection are available.—*Wheelco Instruments Co.* 847 *Harrison St., Chicago* 7, *Ill.*

Mention No. 905 when filling out card.

Tunable Pneumatic Power Unit

New pneumatic power unit consists of a double-acting air cylinder with supporting stand and enclosure, a positioning relay, and a manual operating wheel or lever. Positioning relay incorporates a cam whose shape determines relation of control-drive position to control loading pressure. Three cams are included with each unit and may



Alnor POINTS with PRECISION

Constant Millivolt Characteristics

over a wide range of ambient temperatures are assured by a high manganin to copper ratio plus a series negative temperature coefficient resistor. Automatic cold end compensator adjusts for changes in ambient temperature during a test.

Low Contact Resistance

The selector switch is of heavy duty construction designed for a low and constant value of contact resistance . . . of prime importance when high accuracy is required. Multi-point switch is housed in separate compartment in the case which also contains a high grade mercury in glass thermometer.

Direct Reading

Just turn the switch to the desired circuit and read the temperature directly—no balancing operations or conversion charts. Large 6" scale face is easily and quickly read. Knife edge pointer and mirror eliminate parallax errors. Single or double scale ranges available. Illinois Testing Laboratories, Inc., Rm. 518, 420 N. La Salle St., Chicago 10, Illinois

Overlapping Contacts

When switching from one circuit to another, the new circuit is made before the old is broken . . . the meter circuit is never opened during switching, thus eliminating the possibility of damage due to excessive and wild pointer swing.

portable multi-circuit Pyrometer

Type 1200 precision-built, self-contained, portable that gives instant, accurate readings of temperatures at a number of points in rapid succession. Available with 8 or 17 circuits. Scale ranges from 0-300° to 0-3000° F. and their centigrade equivalents.

Type 1000 Portable Resistance Thermometer with 8 circuit switch for low temperature service. Available in a variety of ranges between —100° F. and +400° F. A span as small as 50° F. can be supplied.

Combining portability with precision laboratory performance, Alnor Portable Multi-Circuit Pyrometers make possible accurate temperature measurement at a multiplicity of points in rapid succession. Type 1200 Pyrometer is particularly valuable in reading temperature rise of various portions of an electrically operated device or repetitive tests on a production run of closely controlled units.

Featuring modern design and rugged construction throughout, Alnor Pyrometers have precision-built double air gap movements of exceptionally high internal resistance . . . famous Alnico magnets . . . the finest in sapphire bearings and hardened steel pivots. Ask your Alnor representative for complete details and prices on these accurate and reliable instruments.

ILLINOIS TESTING LABORATORIES, INC.

Alnor

PRECISION INSTRUMENTS FOR EVERY INDUSTRY

Illinois Testing Laboratories, Inc.
Room 518, 420 N. La Salle St., Chicago 10, Ill.

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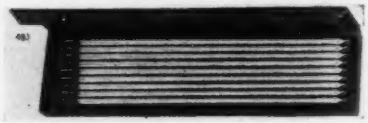
be used interchangeably to obtain positions which are proportional to first power, square, or square root of control loading pressure. For applications where special relationships are required, basic cam shape may be modified easily. Drive requires only 0.10 psi. change in control loading pressure to deliver full supply pressure to piston in the air cylinder. Reaction to increased control pressure may be completely reversed by three adjustments, and drive travel and loading pressure range can be changed. Manual operation is provided by an air supply shutoff valve, a by-pass valve, a hand lever or wheel, and a clamping device. Units are furnished in two sizes—one with 6 in. x 8 in. cylinder for torque requirements of 280 ft.-lb. to 400 ft.-lb. and second has an 8 in. x 16 in. cylinder for requirements up to 1500 ft.-lb.—*Bailey Meter Co.*, 1050 *Ivanhoe Rd., Cleveland* 10, *Ohio.*

Mention No. 906 when filling out card.

Thermometer Testing Set

New "Tag" A.S.T.M.—certified thermometer testing set comprises nine matched thermometers with overlapping ranges, available either in C. or F. Ranges are: –36 to 760 F., –38 to 405 C. Calibrations are in 0.1, 0.2 and 0.5 C.; 0.2, 0.5 and 1 F., with each thermometer accurate to within one scale division. Certificates are obtained by calibration against N.B.S. certified thermometers. Units are made from extra-heavy glass, are 15 in. long and 7 to 8 mm. dia. Expansion chambers give over-range protection. Thermometers are annealed, marked with individual ice points for reference, and have integral rings at top.—*Tagliabue Instruments Div., Weston Electrical Instrument Corp.*, 614 *Frelinghuysen Ave., Newark, N. J.*



Mention No. 907 when filling out card.

Fast-response Thermocouple Assemblies

New thermocouples having speed responses up to nine times those of previous models have mass of hot junction considerably reduced in 8-, 14-, and 20-gage types. Thermocouple wire is shaped to form a loop close to hot junction. Insulator is faced about 1 in. from welded tip, reducing conduction from cold end. Dimensions of loop permit it to fit tightly inside a well, furnishing metal-to-metal contact—*Brown Instruments Div., Minneapolis-Honeywell Regulator Co., Wayne and Roberts Ave., Philadelphia* 44, *Penna.*

Mention No. 908 when filling out card.

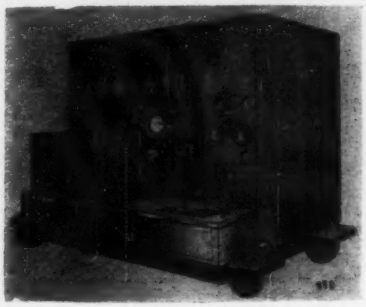
Engine-pressure Analysis Systems

New models of pressure pick-up units, when used with amplifier and oscilloscope, will give pressure-time curve for engine cycle calibrated from amplifier voltages and oscilloscope sweep. (Original model was fully described in our August 1949 issue, page 700.) Dynamic ranges are available up to 3000 psi. with 50-percent extension for static pressure. Frequency response is from zero to well over 20,000 cps.—*Control Engineering Corp.*, 863 *Washington St., Canton Mass.*

Mention No. 909 when filling out card.

Flowmeter-calibration Unit

New flowmeter-calibration stand is primarily for automotive and aircraft industries in engine and nozzle-testing work. Featuring accuracy of 0.1 percent, unit has a flow range of 50 to 45,000 lbs. per hour of fuel. It is available as either a portable or stationary unit and contains built-in reservoir, automatic temperature control, pump, refrigeration and heat-exchange equipment, and automatic density compensation.—*Fischer & Porter Co.*, 63 *County Line Road, Hatboro, Pa.*



Mention No. 910 when filling out card.

Liquid Level Transmitter

New liquid-level pneumatic transmitter, using buoyant force on a partly-immersed cylinder, has a sensitivity of one part in 14,000, and has a reproducibility plus or minus one percent full scale. It is used for differences of level ranging from 14 to 120 in., for liquids of various specific gravities and viscosities, and at working pressures as high as 600 psi. at temperatures up to 450 F.—*Brown Instruments Div., Minneapolis-Honeywell Regulator Co., Wayne & Roberts Ave., Philadelphia* 44, *Penna.*

Mention No. 911 when filling out card.

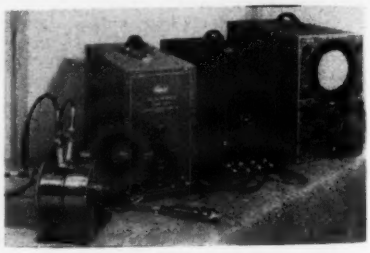
Chronometric Tachometer

New "Totco" chronometric tachometer is mounted in shockproof, neoprene-lined steel case which is moisture- and dust-proof. 90 degree male, 60 degree female, and 6-in. circumference wheel tips are provided. One model measures up to 1000, the other up to 10,000 rpm. Accuracy is 0.01 percent.—*Technical Oil Tool Corp.*, 1057 *N. La Brea Ave., Los Angeles* 38, *Calif.*

Mention No. 913 when filling out card.

Dynamic Pressure-analysis System

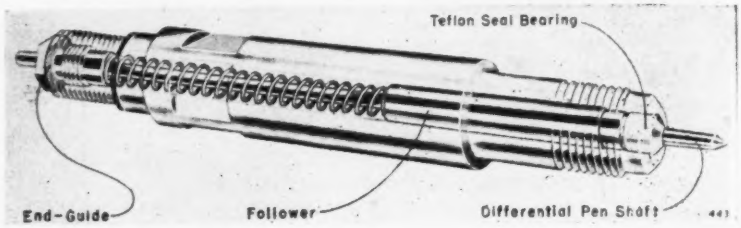
New "Electro Pressuregraph" system for measuring dynamic and static pressures, consists of a pickup, an amplifier and power supply, and a cathode-ray oscilloscope. It will produce full-scale deflections for any pressure or vacuum from a few ounces to over 10,000 psi., and has a frequency response from 0 to over 20,000 cps. Reference-marker signals and identification pulses are provided. Up to three



Stuffing Box for High-pressure Orifice Meters

New orifice-meter stuffing box is leak-proof at working pressures up to 5000 psi. It uses a combination packing and bearing machined from Teflon which is resistant to most reagents and can stand temperatures up to 450 F. Free pen-shaft rotation is obtained at torques down to 9.7 inch-grams.—*Pittsburgh Equitable Meter Div., Rockwell Mfg. Co.*, 400 *N. Lexington Ave., Pittsburgh* 8, *Pa.*

Mention No. 912 when filling out card.



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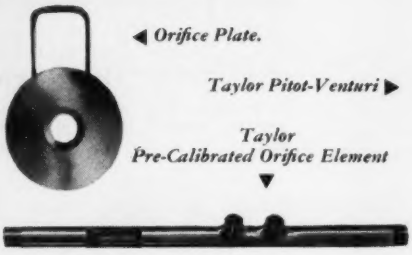
LET TAYLOR HANDLE YOUR FLOW PROBLEMS

• PRIMARY ELEMENTS



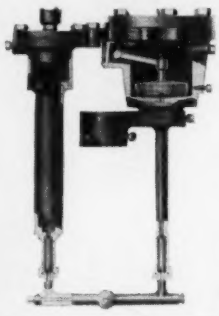
◀ *Orifice Plate.*

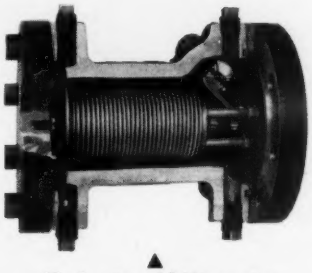
Taylor Pitot-Venturi ▶

Taylor Pre-Calibrated Orifice Element ▼

(1) Thin and thick type Orifice Plates from 2 to 24″ in all standard materials. (2) Pre-Calibrated Orifice Assembly for high-accuracy with pipe sizes less than 2″ are a "Specialty of the House" with Taylor. (3) The new and exclusive Taylor Pitot-Venturi Flow Element which produces greater differential with practically no pressure loss—7 to 10 times greater than by the conventional Pitot Tube. (4) Also standard Venturi Tubes. (5) Flow Nozzles from 3 to 14″ in all standard materials.

• FOR MEASUREMENT



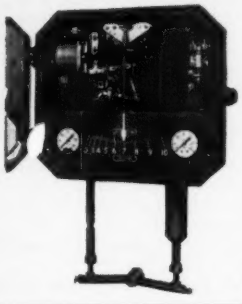


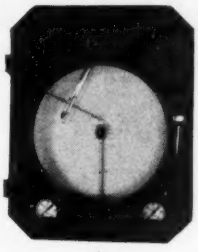
▲ *Taylor Aneroid Manometer*

◀ *New Taylor Mercury Manometer*

(1) New Taylor high-accuracy Mercury Manometer which features Teflon bearings, high energy output, submerged check valves, ½ of 1% accuracy, an adjustable leakless damping unit, and interchangeable range tubes for continuous ranges from 10 to 533 inches of water. (2) Taylor Aneroid (Mercury-less) Manometer, available in All-316 Stainless Steel or Cast Steel, accurately measures flow of hard-to-handle corrosive materials. No mercury to replace, no stuffing box. Sealing fluids or blow-back systems seldom needed. Long service. Easy cleaning. Easy range changes. Both Manometers available with Square Root Integrators.

• FOR TRANSMISSION





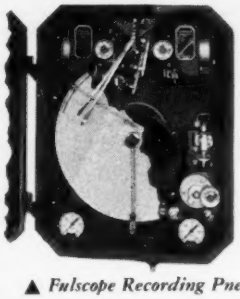
▲ *Fulscope* Recording Receiver Controller*

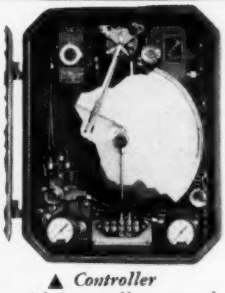
◀ *Taylor Indicating Transmitter*

Taylor Remote Transmission Systems accurately, quickly, economically, and safely transmit rate of flow to conveniently located point. Transmitters can be indicators, recorders or controllers. High accuracy—systems are calibrated to within ½ of 1% accuracy. High speed—only 2-second lag in 300 feet. Gives central control of widely distributed processes at one convenient point. Concentric dial transmitter with Mercury Manometer also available.

*Trade-Mark

• FOR CONTROL





▲ *Controller with internally mounted automatic-manual unit*

▲ *Fulscope Recording Pneumatic-Set Flow Controller*

Indicating or recording controllers in single or double duty form, with adjustable sensitivity or automatic reset. Ratio Flow Controllers with two Manometers attached. Control point may be adjusted by any other process variable. Pneumatic-set controllers whereby control point can be pneumatically adjusted from any remote location. Internally or externally mounted automatic to manual units.

• • •

For complete details, write for new Flow Catalog 98175, or ask your Taylor Field Engineer. He'll show you how Taylor Instrumentation can help you solve *any* flow problem. Taylor Instrument Companies, Rochester, N. Y., and Toronto, Canada.

TAYLOR INSTRUMENTS MEAN ACCURACY FIRST

MODERN
ELECTRONIC
ENGINEERING
GIVES
PRECISE

FINGERTIP SPEED CONTROL

- TACHOMETER PROPORTIONING
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- MOTOR INTEGRATORS
- BI-DIRECTIONAL
- DYNAMIC BRAKING
- SERVO CONTROL

Servo-Tek products co
4 Godwin Ave. Paterson, N. J

information channels may be provided on same diagram.—*Electro Products Labs., Inc.*, 4501 *N. Ravenswood Ave., Chicago* 40, *Ill.*

Mention No. 914 when filling out card.

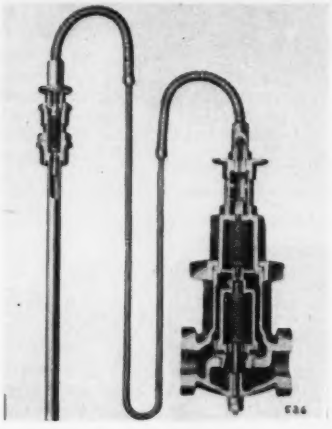
Molten-metal Thermocouple

New thermocouple for temperatures up to 3200 F. permits readings in less than 30 sec. Couple uses 27-gage Pt.-Pt. plus 10 percent Rh. element with a telescoping feature for feeding junction to proper position within protecting tube.—*Wheelco Instruments Co., Chicago* 7, *Ill.*

Mention No. 915 when filling out card.

Self-operated Temperature Controllers

New hermetically-sealed self-operated temperature controller is available in sizes from 0.25 to 6 in. for a single unit, or 2 to 6 in. for pilot operation. Accuracy is 1 F. for ranges up to 350 F. at

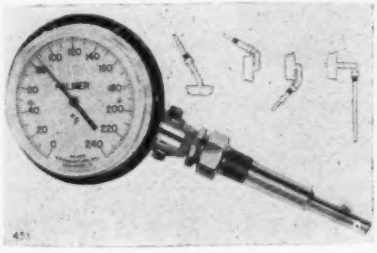


at max. pressure of 150 psi. Finger-tip temperature adjustment is provided on bulb. Basic type has a bronze body with stainless-steel trim and a brass bulb with bronze capillary armor. Bulbs use 1-in. union connection.—*Farris Stacon Corp.*, 610 *Commercial Ave., Palisades Park, N. J.*

Mention No. 916 when filling out card.

Dial Thermometer

New 4.5-in. dial thermometer with flexible capillary permits dial face to be rotated to any desired angle. Nine standard ranges cover –40 to 950 F.

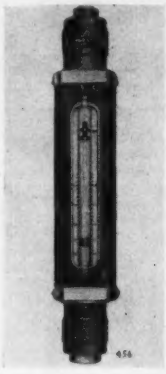


Bulb is of stainless steel, interchangeable with standard industrial-type thermometers. Movement is mercury actuated with Invar compensation. Case is steel with glass front; dust and water proof.—*Palmer Thermometers Inc.*, 2501 *Norwood Ave., Cincinnati* 12, *Ohio.*

Mention No. 917 when filling out card.

Nylon-size Viscosimeter

New indicating viscosimeter for nylon-size service is installed at eye-level directly in size line. Instrument is



available also in remote recording-controlling models.—*Fischer & Porter Co., County Line Road, Hatboro* 2, *Penna.*

Mention No. 918 when filling out card.

Constant-temperature Bath

New constant-temperature bath consists of an insulated stainless-steel tank, circulating pump and stirrer, electric heaters, mercury or bimetal thermoregulator and an external-control box. A choice of 125, 250, 500-watts input may be used. Capacity is 3 gallons. Dimensions are 13.5 in. dia. by 16 in. high. Temperature is held within 0.03 C. at any temperature from 6 C. above ambient to 95 with water or 150 C. with oil.—*American Instrument Co., Inc., Silver Spring, Md.*

Mention No. 919 when filling out card.

Parking Meter

New "Twin-O-Matic Meter," with two meter mechanisms in one housing, permits the parking of two cars at one meter. There is also a companion meter

for the timing of single cars. Seamless housing of the Twin-o-Matic is constructed of aluminum alloy and mechanism is completely rust-proof.—*Karpark Corp., Cincinnati, Ohio.*

Mention No. 920 when filling out card.

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Piston-type Pneumatic Power Unit

New "Grad-U-Motor" piston-type pneumatic positioner providing long-stroke and surplus power has been field tested in damper positioning on diesel-engine air-cooling systems and damper positioning on pneumatic temperature and pressure-control systems. Limitations overcome by piston, compared with diaphragm-type operators, include confinement of stem travel to about three inches.—*Brown Instruments Div., Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.*

Mention No. 921 when filling out card.

Light-scattering Microphotometer

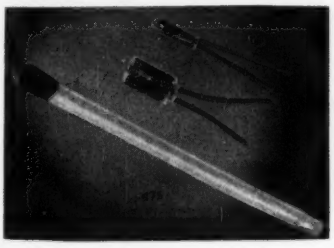
New "Light-scattering Microphotometer" which measures 90 micro-microlumens of scattered light, has a claimed sensitivity approximately 100 times greater than similar instruments. It may be used with any accepted technique for molecular weight, particle size, microfluorescence, depolarization,

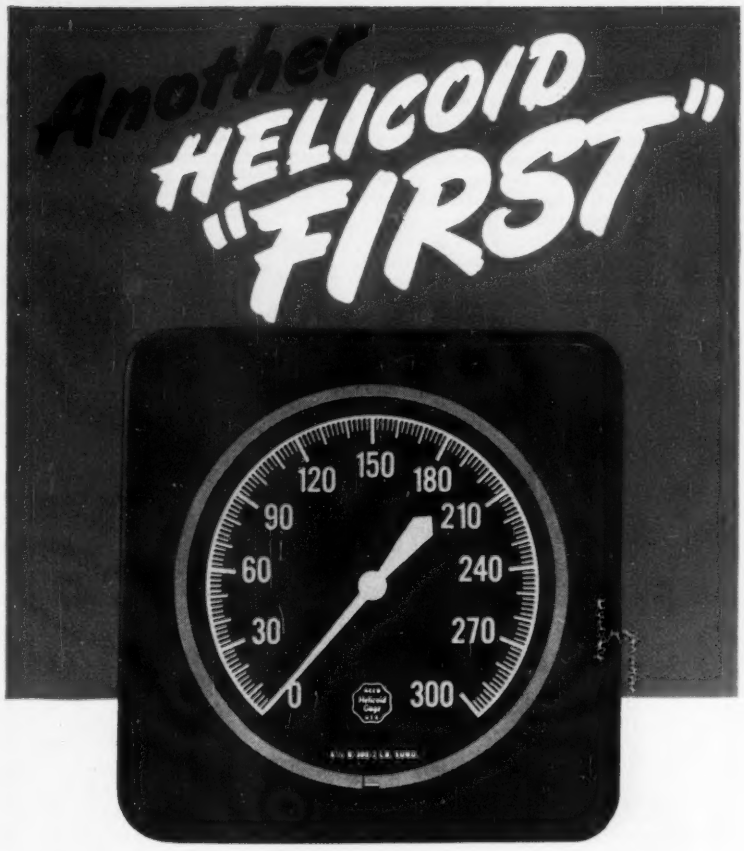
dissymmetry, and microturbidity measurements. Instrument is portable; a-c.-operated; employs two built-in electronic-regulated power supplies, also a d-c. amplifier which operates panel microammeter and which may be connected directly to an external recorder. Full scale deflections of microammeter are made with photo-multiplier tube currents of 10, 1, 0.1, and 0.01 microamperes.—*American Instrument Company, Inc., Silver Spring, Maryland.*

Mention No. 922 when filling out card.

Subminiature Photoelectric Units

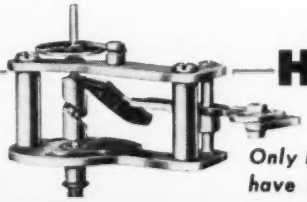
New subminiature photoelectric devices are said to be sufficiently sensitive so that useful current changes are obtained with relatively small changes in light intensity. Applications: decod-





NEW SQUARE, FLUSH CASE GAGE

- ideal for symmetrical panels
- saves space, improves appearance
- 4½", 6" and 8½" dial sizes
- all standard pressure ranges
- with or without internal illumination
- insist on HELICOID GAGES in the new square flush case for that next panel job



HELICOID

ACCO

Only Helicoid Pressure Gages have the Helicoid Movement

HELICOID GAGE DIVISION
AMERICAN CHAIN & CABLE COMPANY, INC.
Bridgeport 2, Connecticut

TRADE MARK

ing punched tape, electronic computing and sorting, direct operation of relays, etc. New unit is essentially a germanium diode especially designed to permit use of photoelectric properties of germanium and similar semiconductors. Transparent plastic, serving as a rugged sealed housing, provides an effective light path to the point at which "whisker" makes contact with germanium. Average sensitivity of units in the point-contact region is about a tenth of a milliampere change in current per lumen for light in the near infrared region—*Sylvania Electric Products Co.*, 1740 *Broadway, New York, N. Y.*

Mention No. 923 when filling out card.

Force Indicators

New increased line of force indicators is available in capacities of 1, 2, 5 and 20 lbs.; 16, 32, 80, and 160 oz.; and 500, 1000, and 5000 grams. Force indicator uses a compensated spring mechanism and fully jewelled dial indicator. Over-all accuracy of individually calculated instruments is ½ of 1 scale division of dial indicator. Six stainless steel force-transmission rod fittings are supplied for measuring force by either a push or pulling action.—*Apparatus Div., Hunter Spring Co., Lansdale, Penna.*

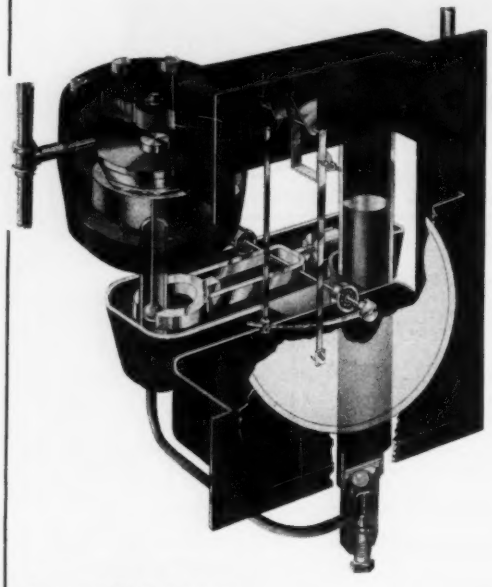
Mention No. 924 when filling out card.

PENN MAGNA CLUTCH Flow Meters

Suitable for working pressures up to 2500 psi.

NO Stuffing Box
Torsion Tubes
Bellows
Diaphragm
Pressure-tight Bearing

therefore
NO HYSTERISIS



Highest Accuracy
Maximum Power, large float and long float travel
Minimum Friction because of magnetic coupling
Ambient Temperature Compensation
Precise calibration check at 50%

Complete Safety
No leakage possible of explosive, inflammable, or toxic fluids

Great Flexibility
5 interchangeable range tubes 17 to 750" with easy range adjustment over entire span

Lowest Maintenance
Fully accessible manometer . . . Only one internal moving part (the float) . . . No bearings to service . . . Mercury volume and level not critical . . . Positive mercury check valves . . . Mercury easily drained.

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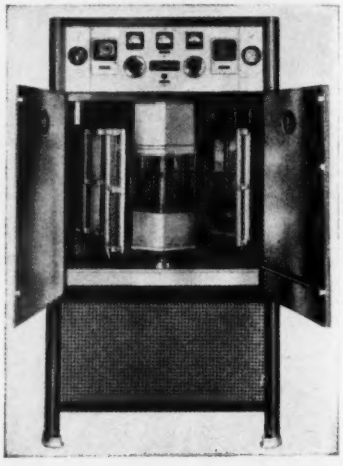
Penn Industrial Instrument Corporation
3116 NORTH SEVENTEENTH STREET, PHILADELPHIA 32, PA.
41 Years of Experience in Flow Measurement

Accelerated-test Equipment for Weather-resistance

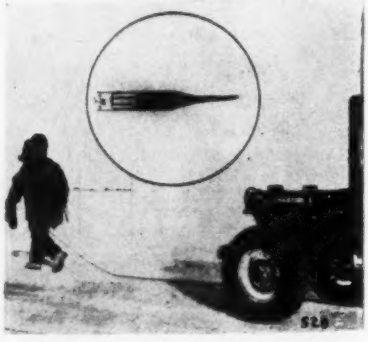
New "Type XW" weathering-resistance testing equipment provides radiation from an open-flame carbon arc, a wide ambient-temperature range by means of rotation of specimen and temperature-control of cooling air, and a spraying system. Capacity is 54 specimens, each 3 by 9 in. Time switch may be set for shut-down after any time from 1 to 24 hours.—*Atlas Electric Devices Co.*, 361 *W. Superior St., Chicago, Ill.*



Mention No. 925 when filling out card.

Air-velocity Meter

New "Ventimeter" for measuring ventilation air flow from 5 to 6000 fpm. uses non-directional probe 0.375 in. long by 0.25 in. dia. which employs a noble-metal thermopile. Indicator is calibrated directly, and is available for operation from 115-v. line or battery supply. Instrument is temperature compensated.—*Hastings Instrument Co., Hampton, Va.*



Mention No. 926 when filling out card.

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all light falling on photographic film

Exposure Meter

Ore Microscope

New microscope is designed to enable mining engineers and geologists to make on-the-spot analyses of ore samples. Opaque specimens measuring up to 4-in. square may be examined with polarized or non-polarized vertical illumination.—*Bausch & Lomb Optical Co., 635 St. Paul St., Rochester 2, N.Y.*

Mention No. 927 when filling out card.

Vertical Image Projector

New "Art-O-Graph" vertical opaque projector produces images of physical objects (as well as of photos, blueprints or drawings) directly on any working

surface. Enlargements up to four times and reductions to about 4.5 times are possible. Base requires only 2.5 by 9 in. floor space.—*J. A. Engle Inc., 634 Syndicate Bldg., Minneapolis, Minn.*

Mention No. 928 when filling out card.

Illuminometer for Street Lights

New "Type PF-13" lightmeter, designed for checking low levels of illumination, both indoors and out, consists of two units—a detector and an indica-

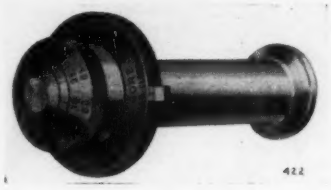
tor. Detector, a light-sensitive cell, is mounted on a self-leveling gimbal. Instrument is calibrated to take readings from 0 to 1 and from 0 to 5 footcandles. —*Meter & Instrument Div., General Electric Co., West Lynn 3, Mass.*

Mention No. 929 when filling out card.

Core-hardness Tester

New "Gordon-Campbell' core-hardness tester measures core-surface hardness by show, on a direct-reading graduated-micrometer dial, depth to which an abrading point enters material during three revolutions and under a constant force. Corresponding hardness value for depth of penetration is found from a table. Dimensions, 2.5 by 2.5 by 5 in.; weight, 1 lb.—*Claude S. Gordon Co., 3000 S. Wallace St., Chicago 16, Ill.*

Mention No. 930 when filling out card.



Schlieren Light Source

New Schlieren light source is a self-contained unit housing power supply, control circuits, lamps, and optical system. It furnishes both continuous and high intensity flash illumination. Operation is from 115-v. 60 cps. line. Unit is of type employing a knife-edge baffle at focal point of image which rejects

. . . and PENN Flow Controllers and Pneumatic Transmitters

It takes Both

Accurate flow measurement

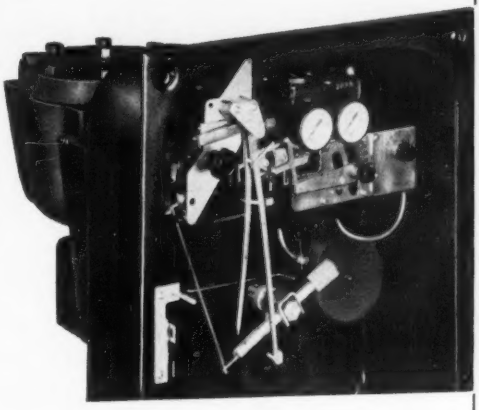
(see facing page)

***plus* a sensitive controller**

For Good Flow Control

Penn's ultrasensitive pneumatic controller incorporates the following low maintenance features:

- Jewelled nozzle and restriction
- Restriction cleaning while in service
- Fixed nozzle—no adjustment
- Few tubing connections
- Easy removal of controller or relay



Temperature, pressure and **level controllers** utilize same control mechanism. All control functions available—on-off, proportional, automatic reset and derivative. Also pneumatic set, time cycle, etc.

WRITE FOR BULLETIN 750 C.

Penn Industrial Instrument Corporation

3116 NORTH SEVENTEENTH STREET, PHILADELPHIA 32, PA.

41 Years of Experience in Flow Measurement

all light falling on photographic film except that disturbed by high or low-density areas in air.—*General Electric Co., Schenectady 5, N. Y.*

Mention No. 931 when filling out card.

Radial Internal Clearance Inspector

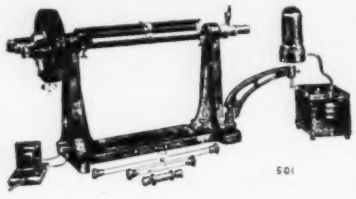
New gaging instrument measures radial internal clearance of ball and roller bearings. Bearing is placed on a horizontal arbor which fits i.d. of inner ring. Foot pedal operations load bearing upward and downward, with outer

ring movements shown on a dial gage. Difference between two readings represents radial play in bearing. Balls are positioned at bottom of grooves by vibrators, operating automatically as load is being applied. Upper and lower measuring load members are adjustable vertically to cover a range of i.d. from 3.2 mm. to 50 mm.—*Sheffield Corp., Dayton, 1, Ohio.*

Mention No. 932 when filling out card.

Polarimeter

New "Model 70" polarimeter consists of a Glan-Thompson type prism and a Lippich type prism forming half-shade image-field. Half-shade angle can be changed over a range of 0 to 20 degrees. For micro-polarimetry, changeable image-field diaphragms of 1, 2, 3, and 6 mm. aperture are available. An-



alyzer circle with scale is completely enclosed, and scale illumination is provided by low-voltage bulbs with filters to match tint of image-field. Coarse and fine drives are provided for rotating analyzer. A detachable lamp arm provides proper positioning of required monochromatic light source. Analyzer scale reads to 0.01 degree, or 0.05 International Sugar Degrees. Test tubes up to 400 mm. long are accommodated. —*O. C. Rudolph & Sons, P.O. Box 446, Caldwell, N. J.*

Mention No. 933 when filling out card.

Exposure Meter

New "SEI" exposure photometer, imported from England, is designed for precision illumination measurement for such work as television or commercial photography. It will measure bright-

ness of pinpoint objects from camera position over ranges of one million to one. Instrument uses a disappearing-dot optical system and is calibrated directly in shutter speeds and stop numbers. Calibration means is build into instrument case.—*The Zoomar Corp., 381 Fourth Ave., New York 16, N. Y.*

Mention No. 934 when filling out card.

Sand-permeability Tester

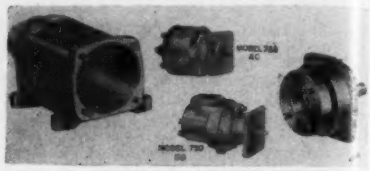
New "Gordon-Campbell Permtester," for sand-permeability measurements is based on principle of measuring time required for a definite volume of air

under constant pressure to pass through standard test specimens. There are no valves or orifices. Permeability values, based on formula proposed by Committee on Foundry Sand Research of the American Foundrymen's Society, are indicated directly on instrument.—*Claude S. Gordon Co., 3000 S. Wallace St., Chicago 16, Ill.*

Mention No. 935 when filling out card.

Tachometer Generator

New "Type E" tachometer generator for use in explosive atmospheres is available as either an a-c, or a d-c, generator; is listed by Underwriters' Laboratories, Inc., for use in Class I, Group D and Class II, Groups F and G locations. It is enclosed in a cast iron housing approximately 10 in. overall and 4.5 in. in diameter. Its stainless steel shaft extends 1.5 in. beyond bearing support. Electrical connection is made in a terminal box tapped to take

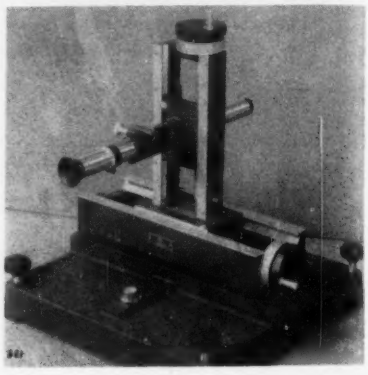


standard conduit. A-c. generator, Model 758, is of the rotating magnet type and is suitable for speeds up to 5,000 rpm. Model 750 d-c. generator has a wound armature with commutator and brushes, and can be operated at speeds up to 2,000 rpm. in either direction. —*Weston Electrical Instrument Corp., 617 Frelinghuysen Ave., Newark 5, N. J.*

Mention No. 936 when filling out card.

Coordinate Cathetometer

New "Cathetometer 1039" measures horizontal and vertical displacements through a 4 in. x 4 in. range. Observations are made through a telemicroscope having a mechanical working distance adjustable from about 5.5 in. to infinity. For shorter working dis-

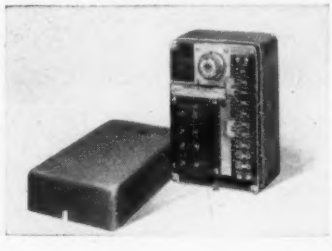


tances, a microscope can be substituted. Measurements are made by divided drums attached to precision lead screws. Accuracy of measurements is governed by the working distance, being greater at shorter distances. The micrometer drums are readable to 0.0001 in. Instrument can be supplied with metric screws and scales.—*The Gaertner Scientific Corp., 1201 Wrightwood Ave., Chicago 14, Ill.*

Mention No. 937 when filling out card.

Automatic Timer

New timer is available in ranges of 0.06 to 1.2, 0.6 to 12, and 6 to 120 sec. Unit features detachable back plate which mounts directly on rigid conduit



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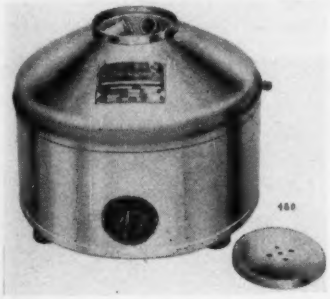
or flat surfaces. Relay armature is only moving part. Contacts handle amperages of 15 for inrush, 10 for carry, and 5 for break.—*General Electric Co., Schenectady 5, N. Y.*

Mention No. 938 when filling out card.

High-speed Centrifuge

New 5000-rpm. centrifuge was designed for semi-micro and micro qualitative analysis in all industries. Six-tube head is totally enclosed with each



tube in a separate compartment. A rheostat provides stepless speed control from 1800 to 5000 rpm. For fast stopping, a friction leather brake has been incorporated. An all stainless steel housing encloses the entire mechanism. "Walking" of the centrifuge is prevented by four suction cup feet.—*Precision Scientific Co., 3737 W. Cortland, Chicago 47, Ill.*

Mention No. 939 when filling out card.

Photocopying Unit

New "Varifile" photocopying unit uses standard 70-mm. roll film with motor and film-metering equipment built in as integral parts. Magazines

are interchangeable from black and white to color or from 70 to 35 mm. Semi-portable model will handle material up to 24 by 36 in., and large model will handle up to 34 by 44 in. Camera may be operated with foot switch.—*Photographic Products, Inc., 6916 Romaine St., Hollywood 38, Calif.*

Mention No. 940 when filling out card.

Solution Conductivity Controller

New "Model REI" solution-conductivity controller features two identical knobs and calibrated scales—one for occasional manual reading, and the

BIDDLE *Instrument News*

NUMBER 1 OF A SERIES

JAMES G. BIDDLE CO., 1316 ARCH ST.
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ELECTRICAL TESTING • SPEED MEASURING INSTRUMENTS • LABORATORY & SCIENTIFIC EQUIPMENT

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Frahm Frequency Meters work on the resonant reed principle. There are no delicate pivots, jewels, or moving systems. Permanent calibration is a natural characteristic of tuned reeds. They require low power input, little maintenance, and are unaffected by wave-form, input voltage, or external fields. Ordinary room temperature variations have little effect on Frahm performance.

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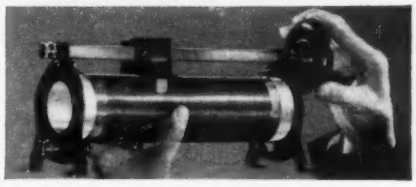
"JAGABI"® LUBRI-TACT POWER RHEOSTATS

Standard Types in 76 Different Ratings



For fine adjustment and control of electrical current—from "zero" to as high as 25 and 50 amperes. Engineers and laboratory workers find "Jagabi" Rheostats have many superior refinements, including the Lubri-tact, graphited carbon lubricator brush which slides with a phosphor bronze current-carrying brush—no scratching or sticking on the resistance winding even at high temperatures. Solid wall porcelain tubes assembled by expert workmanship, with precise adjustment and control, combine to make "Jagabi" a sturdy long lasting construction.

Among the many varieties manufactured by James G. Biddle Co. craftsmen are screw drive rheostats, double rheostats with one or two sliders, water cooled rheostats, graded rheostats up to 24" long with different sizes of resistance wire, switchboard rheostats, rheostats in metal cages, and non-inductive rheostats.

Bulletin 41-I is a thorough description of "Jagabi" Lubri-tact, as well as "Jagabi" Compression Carbon Rheostats for controlling heavy current . . . also "Jagabi" Resistance Units. Your request will bring this booklet by return mail.

NEW PORTABLE SPOTLIGHT GALVANOMETER
Requires No Clamping—Has Knob Control Damping

This precision instrument, made by P. J. Kipp & Zonen, features a moving coil that requires no clamping. Coil is supported between two suspensions and fixed between the pole pieces of a strong permanent magnet. The strength of the magnet may be reduced by a magnetic shunt controlled by a knob, allowing the galvanometer to be critically damped for different external resistances. An Ayrton shunt allows the sensitivity to be reduced in five steps by means of a switch. Bulletin 49-I, mailed on request, describes two types available.

VISIT THE BIDDLE BOOTH AT ISA SHOW

The James G. Biddle Co. booth at location No. 239 will feature a new exhibit with new instruments. Biddle engineers will be in attendance to answer your questions. Come in and say hello!

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other for control. Control knob is in a transparent-plastic covered recess, and manual-reading knob is panel mounted for easy access. Setting of manual-reading knob does not affect control action of instrument.—*Industrial Instruments, Inc.*, 17 *Pollock Ave., Jersey City* 5, *N. J.*

Mention No. 941 when filling out card.

Optical Lens Cleaner

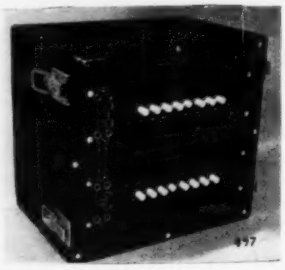
New "Lestra-Lite" optical lens cleaner, containing a silicon base, is available in illustrated 2-oz. translucent-plastic spray bottle. After being

applied to surface of lens by pressing sides of bottle, cleaner works under surface dust and grease, loosening it. When this is removed with a soft cloth, lasting coated surface film remains.—*Pacific Universal Products Corp.*, 168 *N. Vista Ave., Pasadena* 8, *Calif.*

Mention No. 942 when filling out card.

Ultrasonic Half-octave Filter

New "SA-3" ultrasonic one-half octave filter has a range of 10 to 160 kc. in half-octave steps with attenuation of 80 db. per half octave. Minimum

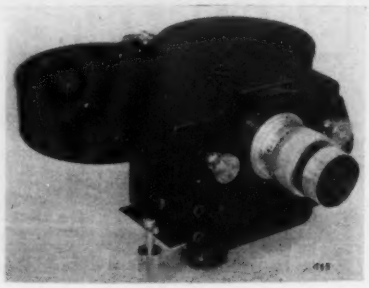


rejection ouside pass band is 40 db. Unit uses passive network without vacuum tubes. It is not subject to overload, there are no beats between normal modes, and intermodulation products are low.—*Gertsch Products, Inc.*, 11,846 *Mississippi Ave., Los Angeles* 25, *Calif.*

Mention No. 943 when filling out card.

Data-recording Camera

New "Type A-1" data-recording camera for 35-mm. film has a 200-ft. capacity magazine and can take pictures up to 4 frames per sec. Frame rate may be controlled by external

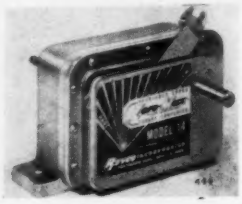


electrical tripping pulse if desired. Camera is designed to be left unattended for long periods of time with castings of high-strength aluminum alloy and bearings of lifetime porous bronze. Film transport is effected by a precision Geneva-type mechanism—*Cook Research Labs.*, 1457 *Diversey Pkwy., Chicago* 14, *Ill.*

Mention No. 944 when filling out card.

Variable-speed Transmission with Reverse

New "Model 14R Zero-Max" transmission with reverse gives infinite speed variation from zero to 425 rpm. at 1750 rpm. input speed in both forward



and reverse. Unit has a rating of 10 in.-lb. on output shaft. Reversal while stationary or in motion, is accomplished by movement of an element about output shaft. Reversal of motor does not change rotation of output shaft.—*Revco Inc.*, 405 *Thorpe Bldg., Minneapolis, Minn.*

Mention No. 945 when filling out card.

Thickness Gage

New "Elcometer" thickness gage (made in England) is available in 7 standard ranges from 0 to 70 mils or up to 0.25 in. on special order. Measurements may be made of non-magnetic coatings on flat or curved surfaces which are magnetic. Instrument pointer

is balanced in all planes and may be locked in position after taking a measurement. Unit is completely self contained.—*Henry A. Gardner Lab., Inc.*, 4723 *Elm St., Bethesda* 14, *Md.*

Mention No. 946 when filling out card.

Optical Viewer-tracer for CRO Patterns

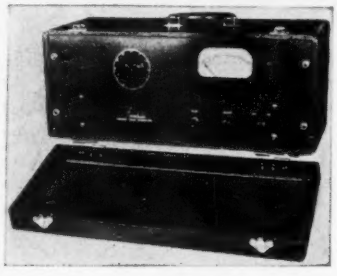
New "Oscillo-Tracer" permits tracing of repetitive cathode-ray patterns directly on graph paper. Standard arm adjusts for use with oscilloscopes hav-

ing tube center to table distances from 9 to 12 in. A double-coated lens is used, with high-reflection upper surface and high-transmission lower surface. Base contains a 115-v. lamp for illuminating writing surface. Unit weighs 2.5 lbs.—*Robert A. Waters, Inc.*, 4 *Gordon St., Waltham* 54, *Mass.*

Mention No. 947 when filling out card.

Control-track Generator for Magnetic Tape

New control-track generator superimposes a high-frequency signal on magnetic tape simultaneously with sound track. High-frequency signal becomes tape-speed control during play-



back, a sort of electronic sprocket. No extra heads or modifications to presently-owned tape recorders are required. Receptacles at rear of case are for audio connections from signal source and to tape recorder's audio-input terminal.—*Fairchild Recording Equipment Corp.*, 154*th St. & 7th Ave., Whitestone, N. Y.*

Mention No. 948 when filling out card.

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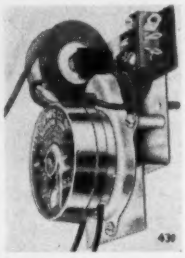
Interval Timer

New "Series 8010", interval timer, at end of preset interval, sounds a buzzer continuously until manually turned off. Unit features a snap action for quick

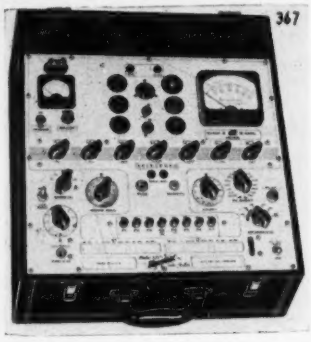


break; is U. L. rated for 16 amp. 250 v., 0.5 hp. at 250 v. a.c. Motor features a 450 rpm. rotor, totally enclosed, with a dual system of controlled lubrication. —*Haydon Mfg. Co., Inc., Torrington, Conn.*

Mention No. 949 when filling out card.

Laboratory Tube Tester

New "Model 539" tube tester reads directly in micromhos. Separate instrument permits adjustment of line voltage while tube is under test. Provision is made for inserting milliammeter to read plate current of tube under test. Unit has three a-c. signal voltages, 0.25, 0.5 and 2.5 in addition to d-c. grid bias

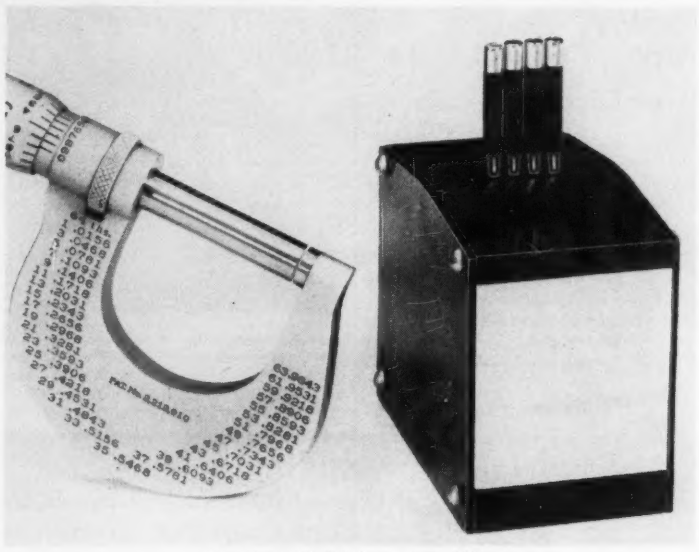


and d-c. plate and screen voltages. Provision is made for self-bias and for vernier adjustment of bias using a 200-ohm rheostat with calibrated dial, bypassed by 1,000 ufd. capacitor which can be inserted in cathode circuit by operating a switch.—*The Hickok Electrical Instrument Co.*, 10519 *Dupont Ave., Cleveland 8, Ohio.*

Mention No. 950 when filling out card.

Soil and Ground Resistance Tester

New "Model 263" measures soil, anode and circuit resistances, and polarization effects. Weight is 9.5 lbs. ready to operate. Resistance ranges are 0-1, 0-10, 0-100, 0-1000 ohms. Power is provided by eight standard flashlight batteries, with a circuit incorporating a synchronous self-rectifying vibrator having an output of 125 volts. Resistance measurements can be made by two-, three-, or four-electrode methods, to give readings in soil varying in re-



Four Trace Model Shown Actual Size

Midwestern Model 102 Galvanometer

LIGHTEST, SMALLEST, MOST SENSITIVE

Product of years of experience in using and developing instruments for industrial users, Midwestern's Galvanometer Model 102, though smaller and lighter than any other now offered to industry, is equal or superior in all mechanical and electrical details including DC sensitivity and balance. It is readily adapted to any type oscillograph; is available in appropriate undamped frequency steps from 50c/sec. to 5000c/sec. Precision manufacture and design have reduced the over-all size of the 102: 18-trace; width—2⅝", ht.— 2¾", wt.—3½ lbs.: 36-trace: width—5", ht.—2¾", wt.—6 lbs. Midwestern is offering this fine instrument at a price which will reduce your galvanometer first-cost approximately 50%, and it will keep your cost down through low maintenance. As an indication of the efficiency of this radically different galvanometer, below are tabulated essential characteristics of two representative elements.

Type	Nominal Undamped Natural Frequency	Frequency Range Flat −5% CPS	Undamped DC Sens. At 15° Opt. Arm. Ma./In.	Req. Damp. Resistance 61% of Critical	Coil Resistance Ohms	Safe Current DC or Peak Ma	Nominal Balance Displacement Per G.*
102-102A	100	0-60	0.008	320	30	3	0.03
102-2000	2000	0-1200	6.100	200	25	50	0.03
				(Fluid 63.5 Magnetic .5)			

*SPECIAL BALANCE TO 0.008" PER G AT SLIGHT EXTRA COST

Midwestern also offers custom repairing of all recognized brands of galvanometers at low cost with fast service.

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Operation and Care of Circular-scale Instruments

By

JAMES SPENCER

For 20 years in charge of Instrument and Relay Department, Meter Div., Westinghouse Electric Corp.

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sistivities from 0 to 1,195,000 ohms per cubic centimeter at 10 ft. or greater spacings. Over-all dimensions are 9 x 6 x 6.5 in.—*Associated Research, Inc.*, 3766 *W. Belmont Ave., Chicago* 18, *Ill.*

Mention No. 951 when filling out card.

Fluorescent-fixture Tester

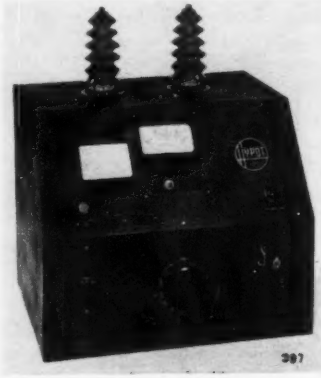
New "Flur-Test" pocket-size tester fits into starter socket to determine if trouble is in circuit, starter, or tube. One model is for 15- to 40-watt tubes

and the other for 85- to 100-watt tubes. Extension adapter is provided for concealed sockets.—*Ideal Industries Inc.*, 1060 *Park Ave., Sycamore, Ill.*

Mention No. 952 when filling out card.

Insulation Breakdown Testers

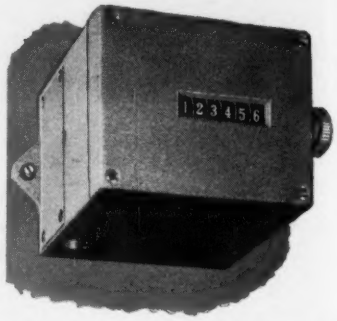
New "570 Series Hypot" high-potential insulation-breakdown testing instruments, with test voltage ranges up to 30,000 a.c. and capacities to 1.65 kva. fill gap in output capacities between maker's portable "Hypot Juniors" and "500 Series." Push-button control in transformer primary is used to energize high-potential output. Output is infinitely variable from zero to max. Breakdown or short circuit in equipment being tested trips high-voltage cutout, which has reset switch on panel.—*Associated Research, Inc.*, 3755 *W. Belmont Ave., Chicago* 18, *Ill.*



Mention No. 953 when filling out card.

Electric Counter

New totally-enclosed counter is rated at speeds up to 600 counts per minute. Unit is actuated by any suitable contactor to handle up to 4 watts. Case



is gasket-sealed cast aluminum with cement-sealed plastic window. Instrument is furnished with 4 or 6 number wheels, key reset, knob reset, or non-reset, for any voltage up to 220 a.c. or d.c.—*Production Instrument Co.*, 702 *W. Jackson Blvd., Chicago* 6, *Ill.*

Mention No. 954 when filling out card.

Explosion-proof Variable Transformers

New explosion-proof model "Powerstat" variable transformers are totally enclosed in a case which will withstand internal gas or vapor explosions. They

are Underwriters' approved for Class 1, Group D service. Various types are available in 115- and 230-volt ratings for single-phase operation.—*The Superior Electric Co., Hannon Ave., Bristol, Conn.*

Mention No. 955 when filling out card.

Variable Transformers

New "Bulletin 76" variable transformers are designed for lighting control but are suitable for industrial or laboratory use where alternating voltage must be adjustable. They are core type auto transformers and are available in two sizes, with maximum load ratings of 5500 and 8000 watts respec-

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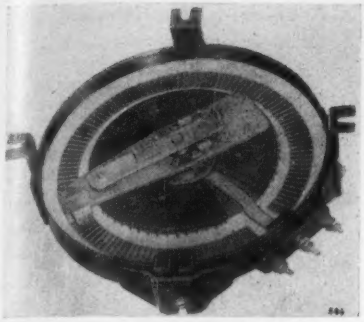
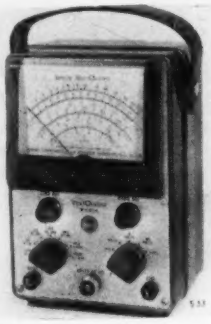


tively on 110-120 volt, 50-60 cycle service. Features include circular metal base plate, toroidal coil and core, solid brass contacts, multiple silver-graphite shoe, oilless center bearings, low core loss and protection against excessive circulating currents. They can be manually or remote controlled motor operated, and can be furnished in all types of mountings and frameworks.—*Ward Leonard Electric Co., Mount Vernon, N. Y.*

Mention No. 956 when filling out card.

Multi-purpose Electrical Tester

New "WV-97A Senior VoltOhmyst" VTVM tester permits measurement of direct voltages of either polarity from 0.1 to 1500 in presence of a.c. A-c. complex waves may be measured up to 1400 v., peak-to-peak, at frequencies up



to 3 Mc. Sine waves may be measured up to 1200 v., rms. Resistance from 0.1 ohm to 1000 megohms is read with 1.5 v. applied to circuit. Accessories include crystal probe which permits rms. measurements up to 250 Mc., and a multiplier which extends d-c. range up to 50,000 v.—*RCA Victor Div., Radio Corp. of America, Harrison, N. J.*

Mention No. 957 when filling out card.

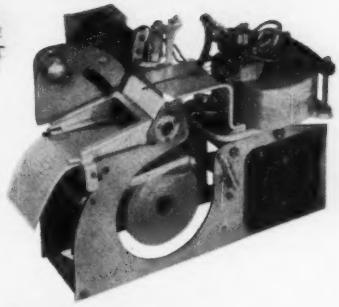
Decade Amplifier

New "Type 500-A" wide-band decade amplifier has a gain of 1000 to 10,000; max. output of 20 v.; zero phase shift from 20 cps. to 100 kc.; and gain sta-

DIRECT WRITING **RECORDERS**

Records are produced by a heated writing stylus in contact with heat sensitive paper. The paper is pulled over a sharp edge in the paper drive mechanism (standard speed 25 mm/sec., slower available) and the stylus wipes along this edge as it swings, thus producing records in *true rectangular coordinates.* The writing arm is driven by a D'Arsonval moving coil Galvanometer with an extremely high torque movement (200,000 dyne cms per cm deflection).

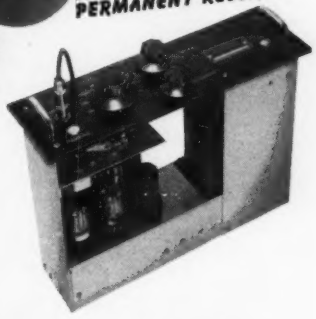
This recorder assembly may be obtained in bare chassis form, as illustrated (51-600) with or without built-in timer; or, with the addition of a stylus heating transformer, temperature controls, and control panel (127); or, with the entire assembly, controls and control panel enclosed in a mahogany carrying case (127C). Complete catalog available, see below.



SINGLE CHANNEL — NO INK — RECTANGULAR COORDINATES — PERMANENT RECORDS

INSTRUMENT **AMPLIFIERS**

A general purpose, A.C. operated driver amplifier for use with model 127 Recorder, comprising three direct coupled push-pull stages. Maximum sensitivity 50 mv. per cm., minimum sensitivity 50 volts per cm., with four intermediate ranges. Balanced input terminals available with impedances of 5 megohms to ground. Complete information in catalog shown below.



AMPLIFIER-RECORDERS

Model shown at right is a single channel unit comprising above Amplifier 126 and Recorder 127, contained in one mahogany carrying case, and designed for use in the industrial field as a direct writing vacuum tube recording voltmeter capable of reproducing any electrical phenomena from the order of a few millivolts to more than 200 volts. More complete data in catalog shown below.

At lower right is a typical "Poly-Viso" multiple channel direct writing Recorder and Amplifier in console. Numerous combinations of this recording equipment and associated amplifiers and accessories are available. The Multi-channel Recorder (Model 165) provides for the simultaneous registration of *up to four* input phenomena, using the same principles and method as for the Recorder Assembly above. In addition, the "Poly-Viso" Recorder provides a selection of eight paper speeds: 50, 25, 10, 5, 2.5, 1.0, 0.5 and 0.25 mm/sec., and for the use of 4, 2, or 1 channel recording Permapaper. The Amplifier equipment is housed in a rack which has space for four individual driver amplifiers (electrically identical to model 126, above) and one 4-channel preamplifier.

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For complete catalog giving tables of constants, sizes and weights, illustrations, general description, and prices, address:

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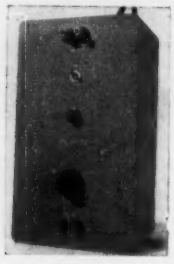
bilization with feedback. Frequency response is flat to better than following figures: within 0.8 db. from 5 cps. to 1 Mc. for A of 1000, 0.5 db from 5 cps. to 1.5 Mc. for A of 100, and 0.5 db. from 5 cps. to 2 Mc. for A of 10.—*Technology Instrument Corp.*, 1058 *Main St., Waltham, Mass.*

Mention No. 958 when filling out card.

High-impedance D-c. Millivoltmeter

New "Type 200-A" d-c. millivoltmeter can detect d-c. voltages as low as 5 uv., or with suitable shunts, currents to a level of 0.1 uua. Output from instrument is a-c. voltage, rms. magnitude of



which is precisely 1000 times that of d-c. input. Transfer gain is stabilized by use of precision components and a strong local feedback loop. A dynamic range of 10,000 to 1, and linearity of output-input proportion are other features. An attenuator is provided at input to extend range of unit up to 10 v. d.c. Unit operates from 115 v. 60 cps. line—*Industrial Control Co.*, 1462 *Undercliff Ave., New York* 52, *N.Y.*

Mention No. 959 when filling out card.

Millivoltmeter

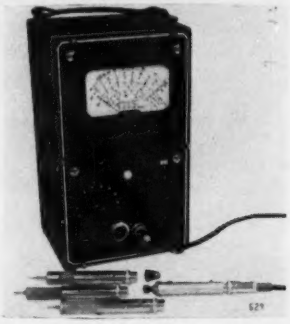
New "Model MV-17b" d-c. millivoltmeter has a variation in calibration of less than 1 percent for 20 percent line-voltage change. First stage of carrier amplifier has gain of over 1,000. Instru-

ment has a sensitivity of 1 mv. full scale with 6 megohms input impedance and ranges up to 1000 v. d.c. at 60 megohms. It may also be used as a micro-microammeter (250 uu amp. full scale) with a separate shunt box.—*Millivac Instruments, P. O. Box* 3027, *New Haven, Conn.*

Mention No. 960 when filling out card.

H-f. Millivoltmeter

New "MV-18B" millivoltmeter is applicable at frequencies from 1 to 200 Mc. with direct calibration, and up to 2,500 Mc. with charts. Sensitivity

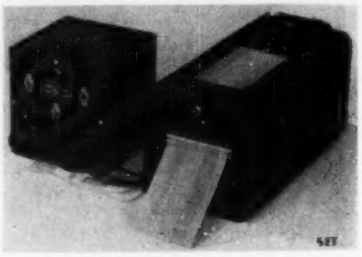


ranges to 1 mv. at 200 Mc. Instrument uses carrier-type d-c. amplifier with negative feedback. Germanium-crystal probes are designed to have 1.0 uufd. input capacitance with a tolerance of 25 percent.—*Millivac Instruments, P. O. Box* 3027, *New Haven, Conn.*

Mention No. 961 when filling out card.

Magnetic Oscillographs

New "Models BL-221," single-channel, and "BL-222" double-channel combination magnetic oscillographs permit a choice of making recordings of elec-

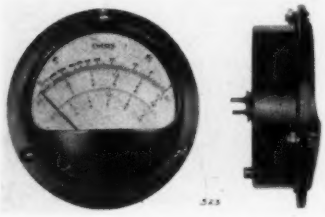


trical phenomena with either a standard inking pen or an electric stylus. A power supply is included with each unit to furnish voltage for electric-stylus operation. Main switch opens circuit to power supply and thus eliminates possibility of receiving electric shock from handling stylus.—*Brush Development Co.*, 3405 *Perkins Ave., Cleveland, Ohio.*

Mention No. 962 when filling out card.

Electrical Indicating Instruments

New 4.5-in instrument, added to maker's "Hermetic Line," has solder type zero adjuster to permit adjustment without breaking hermetic seal,



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and a rubber gasket for use as a pressure seal for panel mounting. Available in a variety of standard ranges with either 1 or 2 percent accuracy rating. Dials are standard or specially calibrated.—*Marion Electrical Instrument Co., Manchester, N. H.*

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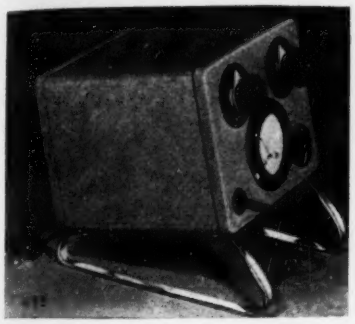
Voltage-adjusting Transformer

New "Model N-202" voltage-adjusting isolation transformer has provision for varying output through range of about 95 to 145 v. in 1.5-v. steps by

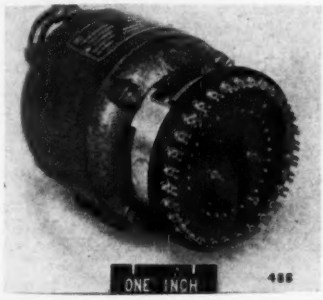


means of two switch knobs with an input of 117 v. Lower input gives lower output range. Capacity is 500 watts. Output voltage is measured with voltmeter having 2.5-percent accuracy. Unit weighs 21 lb., occupies less than 1 sq. ft. of bench space.—*Halldorson Co., 4500 Ravenswood, Chicago, Ill.*

Mention No. 964 when filling out card.

High-speed Multichannel Sampling Switch

New "Model 1-30-30S" high-speed multichannel sampling switch gives 30 break-before-make channels per second from direct drive of a 115-v. 60-cps.



1800-rpm. synchronous motor which permits sampled data to be displayed on an oscilloscope. A similar unit is available with 60 contacts made accessible, using a shorting-type wiper.—*The Applied Science Corp. of Princeton, P. O. Box 44, Princeton, N. J.*

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Electron-tube Tester

New "Model 202" is designed to test all tubes including Noval and subminiatures. Standard emission method of testing gives direct reading. Fea-

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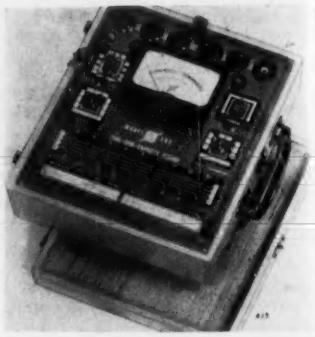
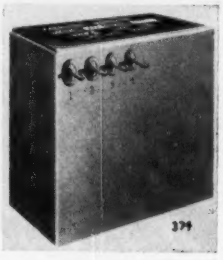


tures include flexible switching arrangement, compensation for line variations between 105 and 135 volts, and a check for shorts and leakages. Capacitor leakage can be checked to 1 megohm, resistance to 4 megohms, and capacitance from 0.01 to 1 uf.—*Electronic Measurements Corp.*, 423 *Broome St., N. Y.* 13, *N. Y.*

Mention No. 966 when filling out card.

Frequency Generator

New "Model 622B" frequency generator operates from 28-v. d-c. aircraft power supply and delivers a 15-v. sinoidal voltage to a 1-megohm load. It is



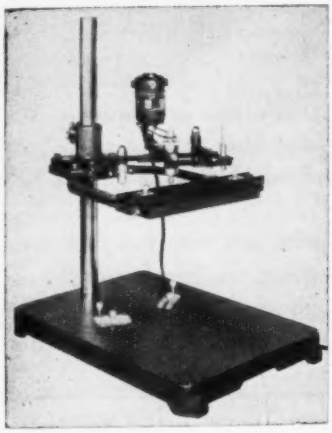
hermetically sealed. Frequency is 400 cps. within 0.1 percent. From –55 to 110 C. Weight is 11 oz.—*Varo Mfg. Co., Inc., Garland, Texas.*

Mention No. 967 when filling out card.

Variable Electronic Filter

New "Model 300 Variable Electronic Filter" has a continuously-variable cutoff within frequency range of 20 cps. to 200 KC. and an attenuation rate of 18 db per octave. Several filters can be cascaded so that attenuation rates of 36, 54, etc. db per octave can be realized. Sections can be combined to make a variable band-pass filter. Instrument in-

MICO ENGRAVER
Model 253



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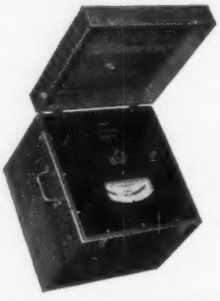
Type 518



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cludes a regulated power supply.—*Spencer-Kennedy Laboratories, Inc., Dep't I, 186 Massachusetts Avenue, Cambridge 39, Mass.*

Mention No. 968 when filling out card.

Multi-purpose Tester for Amplifiers

New "Model No. 402A" tester for wide-band amplifiers measures interelectrode and wiring capacitances of video amplifiers under operating condi-

tions, including Miller effect and inductance of peaking coils. Capacitances from 0.1 uufd to 0.005 ufd and inductances from 1 to 250 u-henries are measured directly. Stability is obtained with a quartz-crystal filter.—*Kalbfell Labs., Inc., 1076 Morena Blvd., San Diego 10, Calif.*

Mention No. 969 when filling out card.

Electrostatic Voltmeters

New electrostatic voltmeters, offered in portable and panel types, have double-pivoted movements. Mirrored scale is 5-in. long with hand-drawn

divisions. Accuracy is 1 percent of full-scale value. Movement is shielded to avoid errors due to stray external fields. Portable type shown is furnished in single ranges, full scale from 120 to 12,000 v., and multi-ranges from 120-240 to 1000-3000-7500 v.—*Cole Instrument Co., 1320 S. Grand Ave., Los Angeles 15, Calif.*

Mention No. 970 when filling out card.

Five-inch C-r. Oscilloscope

New "Model ST-2A" 5-in. oscilloscope incorporates several new features said to increase its usefulness. Most important change is a provision for direct connection to deflection plates by

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Microdial is composed of two concentrically mounted dials . . . one for counting increments of each turn and the other for counting turns. The incremental dial has 100 equal divisions and is attached rigidly to the shaft so there is no backlash. Thus the contact position is indicated to an indexed accuracy of 1 part in 1000. Rotation is continuous in either direction. There are no stops on the Microdial assembly.

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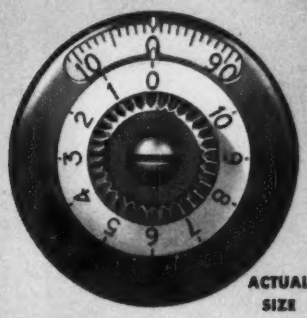

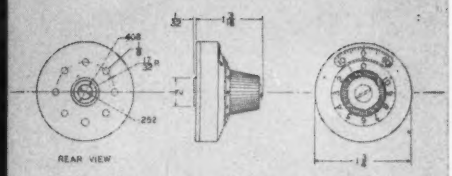

Microdial . . . turn-counting dial, primarily designed for use on Micropot ten turn linear potentiometers . . . use it on any multiturn device having ten turns or less.

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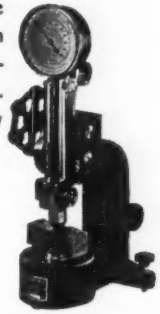

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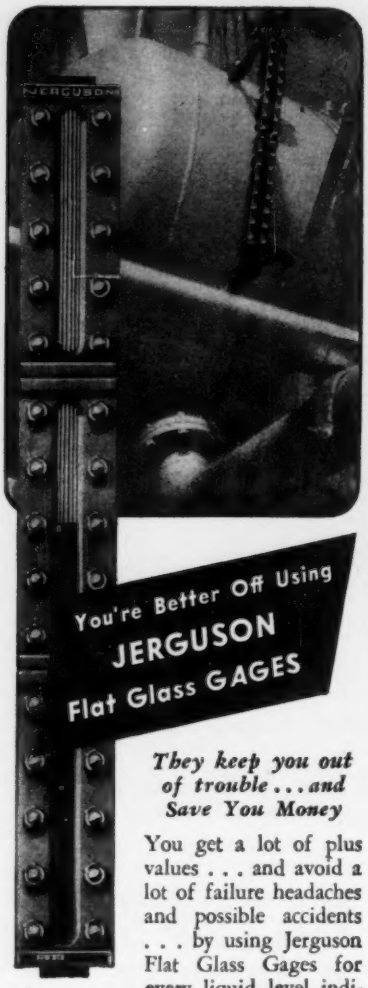

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means of binding posts and switches at rear. Frequency response is independent of gain control settings on both vertical and horizontal amplifiers.—*General Electric Co., Electronics Park, Syracuse, N. Y.*

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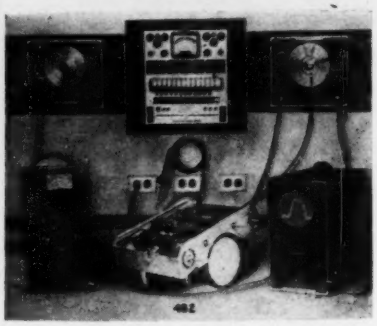
TV, FM and AM Test Set

New panel mounting combination includes Signal-Marker Generator, Tube and Battery Tester, and Sweep Signal Generator. Also included are portable

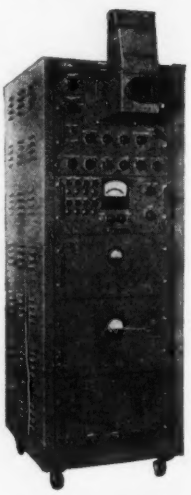


Zero Center VTVM 5-in. oscilloscope, and high-voltage probe.—*Precision Apparatus Co., Inc., 92-27 Horace Harding Blvd., Elmhurst, L. I., N. Y.*

Mention No. 972 when filling out card.

Impulse-test C-r. Oscillograph

New "Type 293" Oscillograph employing a sealed-off high-vacuum cathode-ray tube and means for photographic recording, may be used with standard impulse-test installation. "Type 293" can be triggered by a sample of test impulse, and contains a pulse

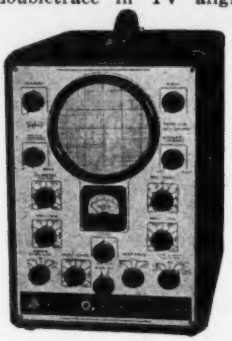


generator to trigger external circuits. An accurate measurement of test impulse is provided by voltage calibration along Y axis and time calibration, along X axis. Permanent records are obtained with a 35-mm. oscillograph-record camera supplied as standard equipment. A data card and color-selective mirror are arranged to permit simultaneous viewing and recording of waveforms appearing on screen of C-r. tube. Driven, logarithmic sweeps may be initiated from an external signal, internal signal, by manual push-button, or from any point in cycle of 60-cycle line voltage. Sweep duration is adjustable in steps from 0.5 to 1000 microseconds. Delay of sweep with respect to trigger output of instrument is continuously variable from 0.5 to 15 microseconds. Bandwidth of both X and Y axes is essentially uniform from d.c. to 25 Mc.—*Allen B. DuMont Laboratories, Inc., 1000 Main Ave., Clifton, N. J.*

Mention No. 973 when filling out card.

Five-inch Oscilloscope

New "Model 3440" 5 in. oscilloscope for TV and general use includes: pattern-reversing switch; calibrated indicator for peak-to-peak voltage measurements; sensitivity of 0.009 rms. v. per in.; built-in feature which eliminates doubletrace in TV alignment;



return trace eliminator; telescoping light shield; linear sweep voltages up to 60 kc.; and frequency range of 20 cps. to over 1 Mc. A Demodulator probe is also available for signal tracing.—*The Triplett Electrical Instrument Co., Bluffton, Ohio.*

Mention No. 974 when filling out card.

Cathode-ray Oscilloscope

New "Type 400" 7-in. oscilloscope has a vertical sensitivity of 10 mv. per in. up to 4 Mc. Linear sweeps range from 10 cps. to 50 kc. Input is 5 megohms at 26 uuf. Other features are: four-position frequency-compensated attenuator, internal 60 cps. sine-wave sweep, control for synchronizing to positive or

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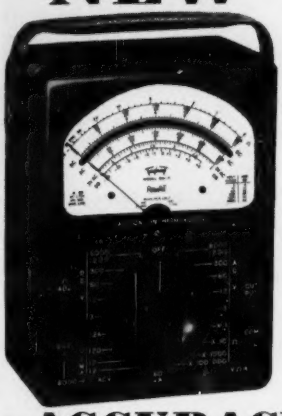

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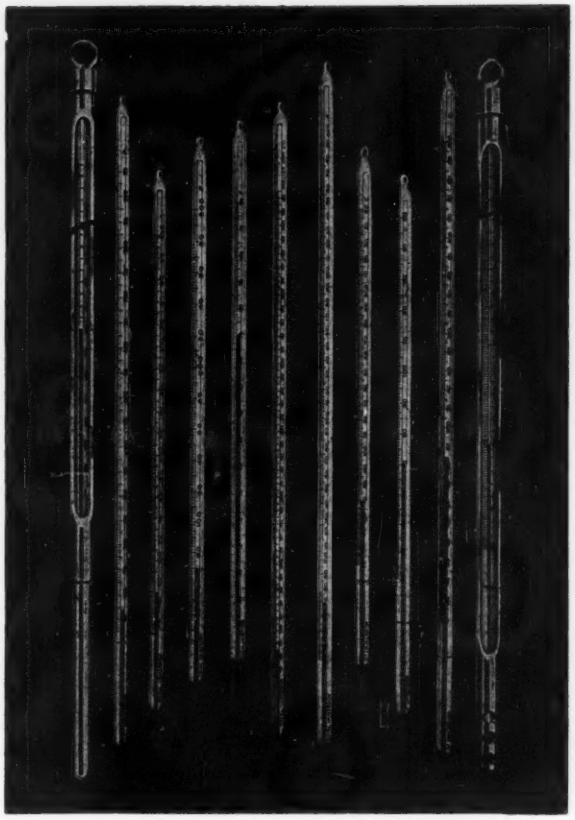

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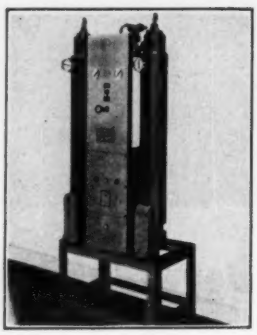

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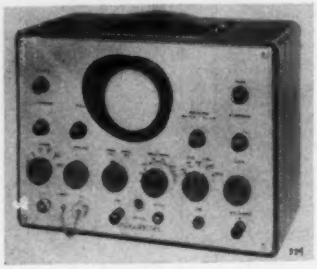
negative signal, and 7JP1 green-screen cathode-ray tube.—*Radio Tube Div., Sylvania Electric Products Inc.*, 1740 *Broadway, New York* 19, *N. Y.*

Mention No. 975 when filling out card.

Service-type Oscilloscope

New "Type WO-57A" oscilloscope for television servicing has a deflection sensitivity of better than 30 mv. per in., and a frequency response of the vertical amplifier flat to within 2.3



db from 0 to 500 kc., down 6.8 db at 1 Mc. Square-wave response is good up to 100 kc. Linear-sweep range is from 15 to 30,000 cps. Instrument uses a short 3-in. tube.—*RCA Victor Div., Radio Corporation of America, Camden, N. J.*

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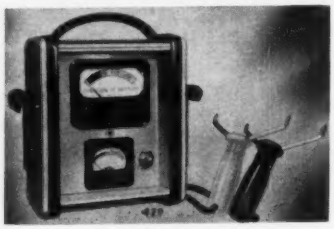
Battery Tester

New "Battery-Scope" tester checks all 3 cells of a storage battery simultaneously. Instrument is encased in stainless-steel housing with panel float-



ing in neoprene. Principle of operation is to balance cells against one another in a bridge circuit using magnetic amplifiers. Total check time is 10 sec. to determine charge and condition of battery.—*McColpin-Christie Corp.*, 4922 *S. Figueroa, Los Angeles* 37, *Calif.*

Mention No. 977 when filling out card.

Regulated Power Supply

New "Model 315" regulated power supply has range continuously variable from 0 to 300 v. at 0 to 150 ma. In range 20 to 300 v. variation is less than 0.5 percent line fluctuations from 105 to 125 v. and load from min. to max. current. Ripple is less than 5 mv. Another range is continuously variable from 0 to 150 v. at 5 ma. Variation is less than 10 mv. for line fluctuations of 105 to 125 v. At 150 v. regulation is less than 0.5 percent between 0 and 5 ma. At settings below 150 v. internal resistance of supply will increase to a max. of 25,000

ohms. Ripple is less than 5 mv. A-c. output is 6.3 v., 5 amp., center-tapped, unregulated.—*Kepco Labs. Inc.*, 149-14 *41st. Ave., Flushing, N. Y.*

Mention No. 978 when filling out card.

Fifty-kv. Power Supply

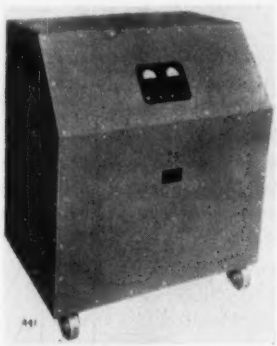
New "PS-50" power supply with an input of 117 v., 60 cps. puts out 50 kv. at 1 ma. with a ripple of less than 1

percent and a regulation of 4000 v. per ma. Weight is 85 lb.—*Condenser Products Co.*, 1375 *N. Branch St., Chicago* 22, Ill.

Mention No. 979 when filling out card.

D-c. Power Supply

New "Model E-28-150" regulated d-c. supply gives an output of 28 v. adjustable within 10 percent at a current of 15 to 150 amp. Regulation accuracy is



0.25 percent against line or load, and ripple 1 percent max. Input is 115 or 208 v., 3 phase, four wire.—*Sorensen and Co., Inc.*, 375 *Fairfield Ave., Stamford, Conn.*

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Regulated D-c. Power Supply

New "Ranger" d-c. power supply with an input of 95-130 v., 50-60 cps. is available in three models with out-

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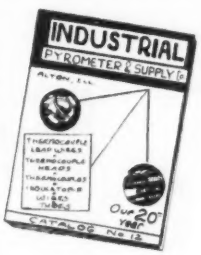

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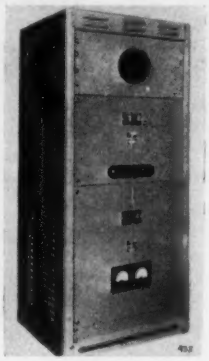
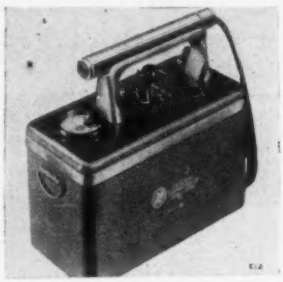


percent of output setting.—*Sorensen & Co., Inc.*, 375 *Fairfield Ave., Stamford, Conn.*

Mention No. 981 when filling out card.

Alpha-Beta-Gamma Portable Counter

New "Model 2611" count rate meter is battery-operated and uses a thin mica end window probe, with density of 1.4 mg. per sq. cm. Instrument reads directly in counts per minute, or milli-



roentgens per hour for gammas. A switch selects ranges of 0.2, 2, or 20 mr. per hour. Headphones are furnished, and a metal cover on the end of the counter permits use for gamma surveying only.—*Nuclear Instrument and Chemical Corp.*, 229 *W. Erie St., Chicago* 10, *Ill.*

Mention No. 982 when filling out card.

Radioactivity Survey Meter

New "Mark 11, Model 10" alpha-beta-gamma survey meter has a double range of 0-2000-10,000 counts per minute. It will detect one milli-micro curie of carbon 14 if held directly over a layer of this isotope. A 1.875-in. fusion-

seal mica-window counter with less than 2 mg. per sq. cm. thickness and a grid over mica window allow detection of all radiations. Operation is from 110 v. 60 cps. current. Weight is 4 lb.—*Radiation Counter Labs., Inc.*, 1844-50 *W. 21st St., Chicago* 8, *Ill.*

Mention No. 983 when filling out card.

Geiger Counter Kit

New "Searchmaster" Geiger counter kit contains tubes, batteries, resistors, capacitors, sockets, type SK-1 Geiger tube, headset, and metal case. Illus-

trated instructions and the AEC book "Prospecting for Uranium" are included.—*Science Kits, Ltd.*, 5514 *Hollywood Blvd., Hollywood* 28, *Calif.*

Mention No. 984 when filling out card.

Radiation Monitor

New "Model K-900" a-c.-operated radiation monitor comes equipped with aluminum thin-wall Geiger tube, sensitive to beta and gamma radiation. Tube is mounted in a probe connected to main cabinet by self-retracting cord. Count-

ing rate is shown on indicator, flashing neon bulb, and variable volume speaker. Instrument indicates either counting rate, or voltage applied to Geiger tube. Tube voltage is adjustable from 500 to 1000 volts. An internal pulse generator synchronizes with line frequency for calibration. Instrument weighs 15 lbs., is 8 in. square.—*Instrument Div., Kelley-Koett Mfg. Co.*, 125 *E. Sixth St., Covington, Ky.*

Mention No. 985 when filling out card.

Radioactivity Monitor

New "Model 1615" laboratory monitor for alpha-beta-gamma detection may be used to count samples with activities between 100 and 50,000 counts per minute where accuracy of measurement need not be better than 3-percent standard error. A chart-type recorder may be attached for maintaining a permanent written record. A choice of five different ranges, from 500 to 50,000

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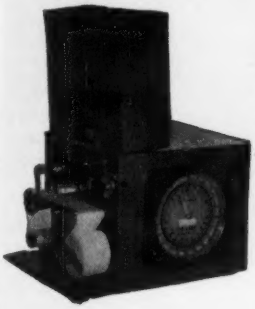

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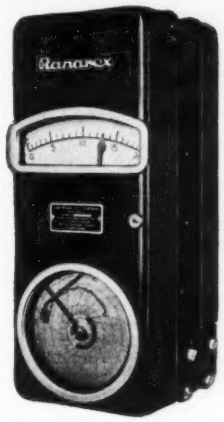

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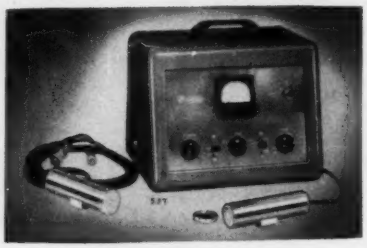


counts per minute full scale, is provided. Suitable time constants in each range, in conjunction with a switch permitting choice of standard error allow either 3 or 20-percent error to be read on any range if desired. Instrument incorporates a loud speaker with controllable volume and a high-voltage supply controlled from front of panel. —*Nuclear Instrument and Chemical Corp., 229 W. Erie St., Chicago 10, Ill.*

Mention No. 986 when filling out card.

Gamma-ray Detector

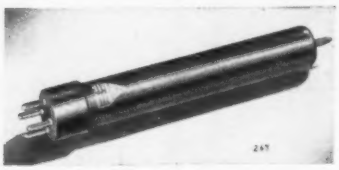
New "Model K-550" gamma-ray detector uses a subminiature type Geiger tube with a cosmic-radiation background of about 12 counts per minute. Dimensions are 4.75 by 2.625 by 1.125

in. and weight is 10 oz. Battery power consists of two 30-v. hearing-aid type and one standard 1.5-v. flashlight cell. Pulses are heard with hearing-aid type receiver. Case design is smooth and sealed for waterproofing and decontamination. Only control is on-off switch.—*The Instrument Div., Kelley-Koett Mfg. Co., 125 E. Sixth St., Covington, Ky.*

Mention No. 987 when filling out card.

Bismuth-wall Gamma Counter

New "Mark 1, Model 12" gamma counter has a glass wall with bismuth screen. Operating voltage is 950 with



a plateau of 150-200 v. Life is approx. 100 million counts. Base is standard 4-prong.—*Radiation Counter Labs., Inc., 1844-50 W. 21st St., Chicago 8, Ill.*

Mention No. 988 when filling out card.

Radioactivity Counter Tube

New "Model D46A" counter has long plateau and low-voltage operation with a shielded background of 17-18 counts per minute at Chicago elevation. Counter has a Q-gas flush time between samples of ten seconds. Resolution time is approx. 100 microseconds. Starting potential is 1025 v.; plateau is 400 v. with a slope of less than 3 percent per hundred v.—*Nuclear Instrument & Chemical Corp., 223 W. Erie St., Chicago, Ill.*

Mention No. 989 when filling out card.

Neutron Counter

New proportional-counter tube, sensitive to thermal neutrons has cathode cylinder made from seamless-steel tubing. Internal surfaces of cylinder are coated with metallic boron enriched in

boron-10 which has a large effective area for capture of slow neutrons. Cylinder is filled with a gas mixture to obtain self-quenching action. Counter is so constructed as to have all external high-voltage points shielded electrically and physically. Tubes of 8 inch and 12-inch sensitive length are available. —*General Electric Co., Schenectady 5, N. Y.*

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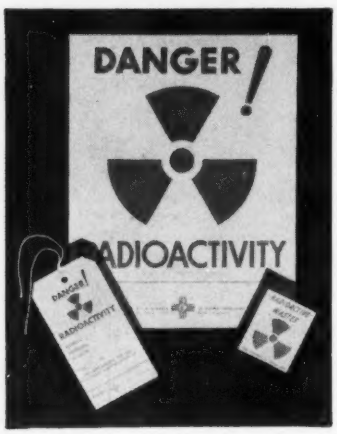
Radioactivity Warning Signs

New radioactivity warning signs and tags bearing official magenta insignia on a brilliant-yellow back-ground are



now available as signs, strung tags, and waste labels.—*Atomic Instrument Co., 160 Charles St., Boston, Mass.*

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New "Model 805" lead shield is designed for carrying or storing radioisotopes in standard 30-cc. vaccine or glass stoppered bottles. Shield has alu-

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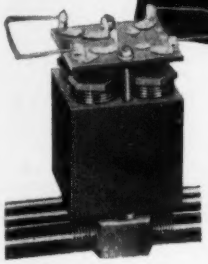

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30 to 240°F.	100 to 400°C.	

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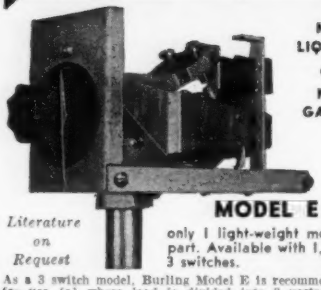

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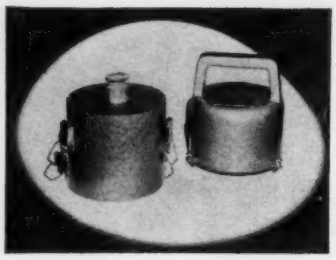
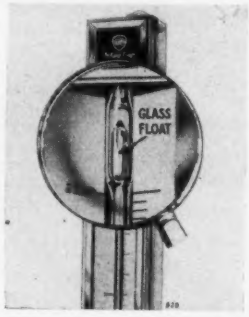


minum inner and outer shells and provides a minimum lead wall thickness of 1 in. in all directions. Inner chamber measures 1.5 in. by 4 in.—*Atomic Instrument Co., 160 Charles St., Boston, Mass.*

Mention No. 992 when filling out card.

All-glass Overflow Check Valve

New all-glass overflow check valve prevents loss of indicating gage or manometer liquid due to surge pressures. Unit consists of a glass float-

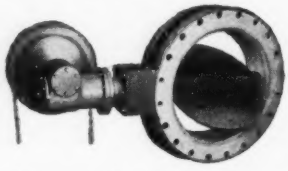


check in a glass cylinder. Cylinder has a seat at top opening, and a glass tube below for connecting to instrument. Mating surfaces of float and cylinder are ground and lapped. Standard dimensions are 6 in. over-all height, with glass connecting tube of 7 mm. OD.—*King Engineering Corp., Box 300, Ann Arbor, Mich.*

Mention No. 993 when filling out card.

Rubber-lined Valve

New "No. 737" 50-lb. rubber-lined valve is available in sizes from 2 to 72 in. for a temperature range of –40 to 275 F. Hard or soft-natural or synthe-

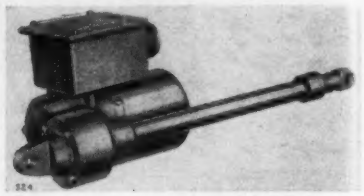


tic rubber may be used. Angular seating vane for wedge-type closure gives tight shut-off. Since rubber is not flexed or distorted, wear resistance to abrasives is high. Lining permits use of iron body for many corrosive applications, and eliminates need for usual flange gaskets.—*R-S Products Corp., Wayne Junction, Philadelphia 44, Pa.*

Mention No. 994 when filling out card.

Linear Power Unit

New linear power unit has hardened ground screw and nut with ball-thrust bearings capable of 175-lb. tension or compression loads. Stroke is adjustable up to 5 in. Bronze-bushing eye or self-

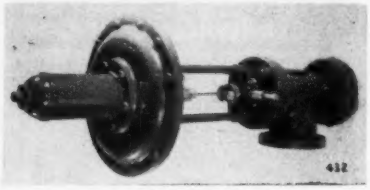


aligning and shock-absorbing bonded-rubber connectors are available. Limit switches are accessible for adjustment after unit installation. Speed reduction is through machine-cut gears. Designed to meet all applicable AN requirements, units are available for two-position or proportioning control.—*Barber-Colman Co., Rockford, Ill.*

Mention No. 995 when filling out card.

Steam-jacketed Flow-control Valve

New flow-control valve has steam-jacketed body. Chrome-nickel seat is removable. Chrome-nickel stem is lubricated. Valve is actuated by a flanged

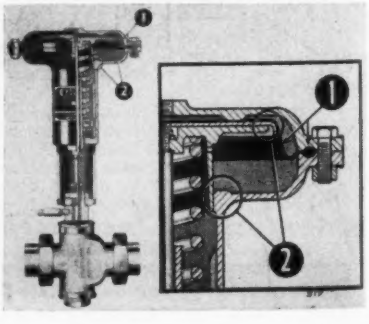


diaphragm-motor in conjunction with any standard air-operated control instrument. As a safety feature for use with hot inflammable fluids, valve is normally furnished spring-closing; air to open.—*G. D. Jenssen Co., Inc., P. O. Box 401, Watertown, N. Y.*

Mention No. 996 when filling out card.

Diaphragm-motor Valve

New "Flowrite" valve for industrial process control is available for pressures up to 250 psi., in sizes from 0.25 in. to 8 in. Valves are designed for steam, water, oil, or gases, with a variety of valve bodies. Trim is stainless steel or bronze. Valve top features molded Neoprene diaphragm with seal-



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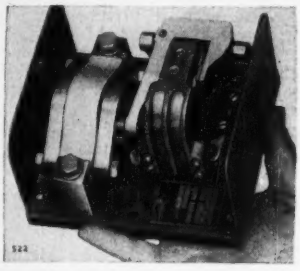
ing bead, and a free-floating thrust plate. Housing and top-work are of cast iron. Operating pressure adjusting screw is ball-bearing, non-rising type, with enclosed rust-proofed steel spring for full travel in 5 or 10 psi. control pressure change. Bonnet assembly has polished stainless steel stem in lubricated metallic packing—*Powers Regulator Co., 2734A Greenview Ave., Chicago* 11, *Ill.*

Mention No. 997 when filling out card.

Magnetic Air Valve

New magnet-operated valve is designed as a four-way four-port, 0.375 in. valve, for control of double-acting air cylinders. It can be converted to three-way, or two-way operation, by plugging proper ports. Pressures up to 100 psi. can be handled. Over-all

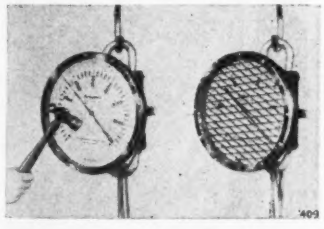


dimensions are 4 in. x 6.5 in. x 5.75 in. Valve will operate continuously at 300 cycles per minute, and at speeds up to 600 cycles per minute on intermittent duty. Magnet coil requires 38 volt-amperes at 60 cycles and 215 volt-amperes inrush. Valve body and rotor are made of manganese bronze. Rotor is pressure-balanced and has spring loaded vanes. All magnet parts are hardened. Valve may be mounted in any position.—*Square D Company,* 4041 *N. Richards Street, Milwaukee* 12, *Wis.*

Mention No. 998 when filling out card.

Hydraulic Scale

New model of hydraulic scale is now available in ranges up to 500 or 100,000 lb. Dial glass will bend as much as



20 degrees without breaking and stand thermal shocks up to 500 F.—*Hydroway Scale, Inc.,* 20624 *W. Eight Mile Rd., Detroit* 19, *Mich.*

Mention No. 999 when filling out card.

Internal Groove Gage

New self-positioning dial groove gage measures internal-groove diameters and recesses used for precision retaining rings, snap rings, O-rings, oil and washer grooves, etc. Dial indicator has

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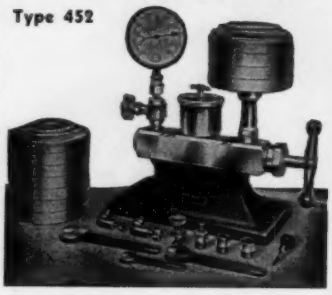

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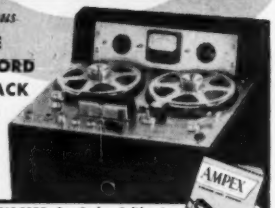

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Mention No. 1000 when filling out card.

Vacuum Pump

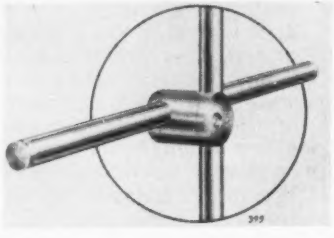
New "Model CVD 3534" vacuum pump employs oil-seal pumping system, has a free-air displacement of 4.9 cfm., operates with a 0.33-hp. motor. On a

blank test, each unit is required to produce McLeod-gage absolute-pressure readings of 0.1 micron or better. Model is less than 16 in. high.—*Kinney Mfg. Co., 3607 Washington St., Boston, Mass.*

Mention No. 1001 when filling out card.

Laboratory Frame Clamp

New stationary clamp, in a modern-functional shape with polished finish, is manufactured of high-strength high-

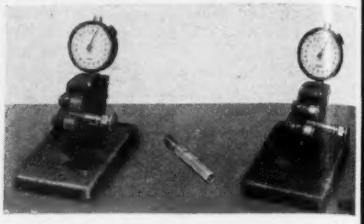


melting aluminum alloy which will not disintegrate in Bunsen-burner flame.—*Emil Greiner Co., 20-26 N. Moore St., New York, N. Y.*

Mention No. 1002 when filling out card.

Thread Comparator

New "Tri-Roll" thread comparator for checking male threads cradles parts to be measured between two stationary gaging rolls and a third roll, mounted on a preloaded armature, is swung into



contact. A dial indicator graduated in increments of 0.00025 in. gives cumulative readings of errors in lead, angle and pitch dia. Initial setting is established with a setting plug, after which exact amount of deviation in over or undersized threaded parts is registered on dial.—*Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.*

Mention No. 1003 when filling out card.

Glare-free Drafting Instruments

New line of drafting instruments includes T-squares, French curves, and protractors lightly colored in eye-resting green to refract room light and remove paper glare, yet with complete transparancy.—*Berger Scientific Supplies, Inc., 342 Madison Ave., New York 17, N.Y.*

Mention No. 1004 when filling out card.

Shop Microscope

New "Model 233" wide-field microscope has entire field in focus. It is free from prismatic aberration and has a

high light efficiency. Magnification range is from 20x to 60x. It is adjustable for any magnification between these figures.—*Clarkstan Corp., 11927 W. Pico Blvd., Los Angeles 64, Calif.*

Mention No. 1005 when filling out card.

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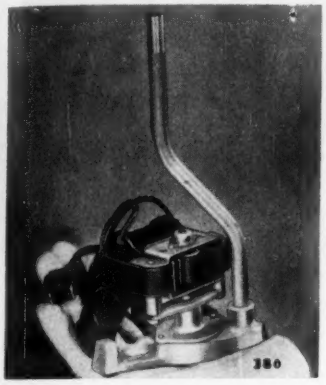
Laboratory Pump

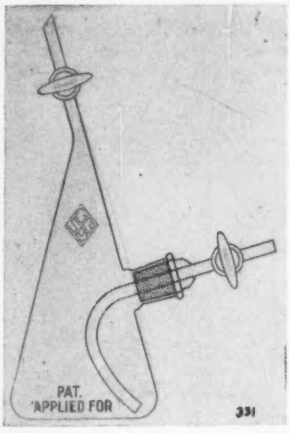
New miniature laboratory pump has over-all height of less than 3 in. and weighs 16 oz. Max. head is 40 in.



water and max. capacity is 75 gph. at zero head.—*Samuel S. Gelber Co.*, 162 *N. Clinton St., Chicago 6, Ill.*

Mention No. 1006 when filling out card.

Combination Flask and Separatory Funnel



New flask and separatory funnel combined is made of Pyrex.—*Scientific Glass Apparatus Co., Inc.*, 49 *Ackerman St., Bloomfield, N. J.*

Mention No. 1007 when filling out card.

Flame-failure Safeguard

New "FF-3" flame-failure safeguard consists of scanner and control which is tied into starting system of oil

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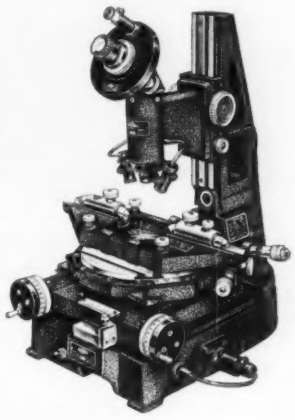

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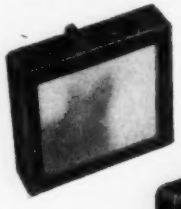

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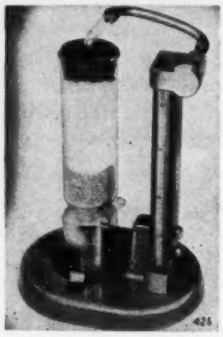
burner. Load rating is 1 hp. plus 125 va. pilot duty at 115 or 230 v. a.c.—*Combustion Control Corp., 77 Broadway, Cambridge 42, Mass.*

Mention No. 1008 when filling out card.

Oxygen-purifying Train

New "No. 3004" oxygen-purifying train for removing carbon and sulfur gases passes oxygen through flowmeter, reading from 0 to 3 liters per min.,

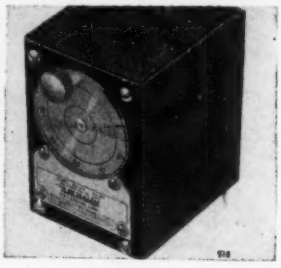


then through a jar containing anhydrone for drying and ascarite for purification.—*Harry W. Dietert Co., 9330 Roselawn Ave., Detroit 4, Mich.*

Mention No. 1009 when filling out card.

Adjustable Dial for Time-delay Relays

New adjustable dials are now available for maker's time-delay relays.

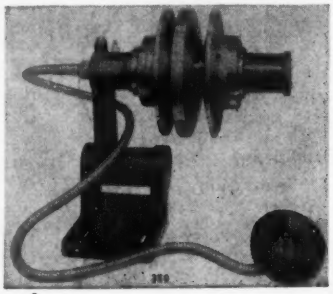


Delay time can be changed easily, but once set, is positively locked.—*A. W. Haydon Co., Waterbury, Conn.*

Mention No. 1010 when filling out card.

Variable-speed Pulley

New variable-speed pulleys provide speed ranges of 3:1 in durable plastic models which are equipped with steel-faced sheaves and designed for drives

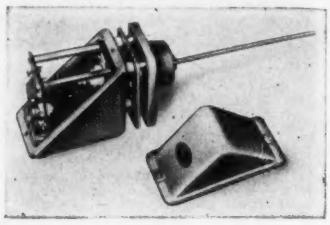


of 0.75 and 1 hp. An aluminum-alloy model delivers a 2.1 range on drives of 1, 1.5 and 2 hp.—*American Type Founders, 200 Elmora Avenue, Elizabeth 3, N. J.*

Mention No. 1011 when filling out card.

Combustion Safeguard for Gas Burners

New "Fireye System FF-6" operates with a probe in contact with pilot or main gas flame. Flame failure results in alarm and stopping of fuel flow. Unit

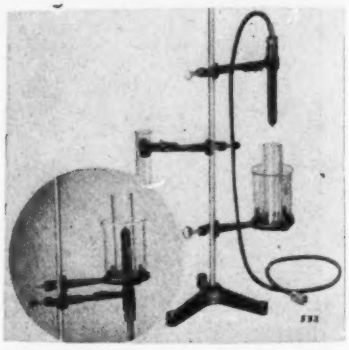


operates from 115 or 230 v., 50-60 cps. to control a load of 1 hp. plus 125 va. pilot duty. Control will operate in an ambient-temperature range of 32 to 125 F.—*Combustion Control Corp., 77 Broadway, Cambridge 42, Mass.*

Mention No. 1012 when filling out card.

Liquid Counter Set

New liquid-counter set includes a Marinelli-type beaker and plug-in type counter over which beaker can be placed. A test tube of correct size is



provided so that Geiger tube may be used as a dip counter. For beta counting, test tube is filled with 20 cc. of active liquid which then covers sensitive area of counter. Counter is all glass and is easily decontaminated.—*Nuclear Instrument and Chemical Corp., 229 W. Erie St., Chicago 10, Ill.*

Mention No. 1013 when filling out card.

Spring-powered Drives

New mechanical drives for instruments are about 3.25 in. dia., and 2 in. thick. One model has 8-day wind with basic 24-hour rotation which may be converted to 2, 3, 4, 6, 8, 12, 48-hour, 3, 7, or 8-day rotation by use of snap turrets. Other model has 24-hour wind, during which time torque drops from 8.6 to 4.7 in.-lb. Detachable escapement

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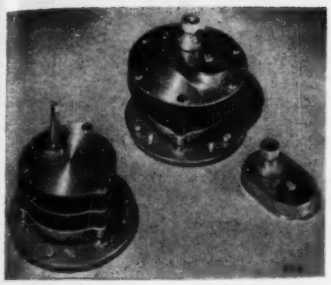
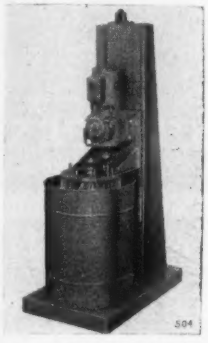


sealed in clear plastic is protected against dust and corrosive gases. Special escapements permit speeding up of chart drives.—*Pittsburgh Equitable Meter Div., Rockwell Mfg. Co., Pittsburgh 8, Pa.*

Mention No. 1014 when filling out card.

Laboratory Fermentor

New "Fermentor" is for laboratory culturing of aerobic micro-organisms, and production of antibiotics and yeast. Operating capacity ranges from 10 to

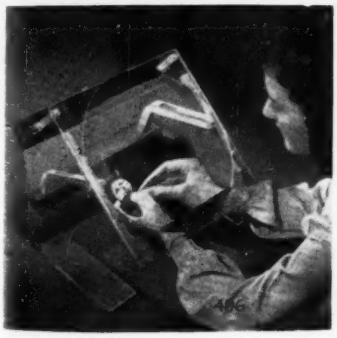


18 liters. An agitation-aeration device draws in air by suction, behind stirring blades. A disk and cone, rotated at high speeds, breaks foam by centrifugal force. Adjustable speeds from 0 to 1200 rpm. are provided from a 0.25 h.p. motor. Over-all dimensions 20 x 58 x 32 in.—*Precision Scientific Co., 3737 W. Cortland St., Chicago 47, Ill.*

Mention No. 1015 when filling out card.

Inspection Lens and Light-source

New "Colorama" lens mounted with light source is available in 3, 6, and 8 power, in 12-in. dia. size. 3 and 6 power lens is available in 14, 16, 18, and 20-



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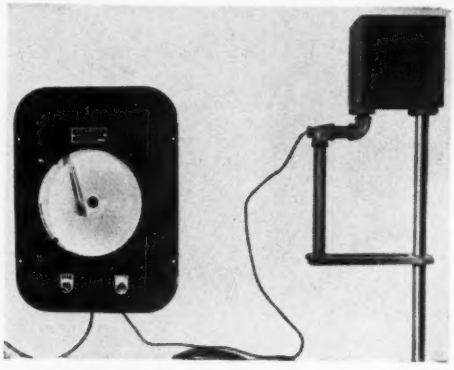

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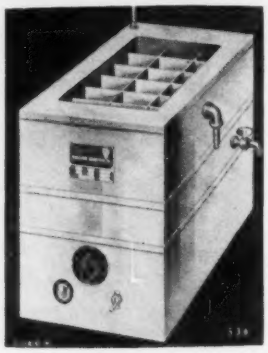
in. sizes. Lenses are made of clear plastic with fluid sealed within. Lamps are of fluorescent type.—*Engineers Specialties Div., Universal Engraving & Colorplate Co., Inc.*, 980 *Ellicott St., Buffalo* 8, *N. Y.*

Mention No. 1016 when filling out card.

Tissue Embedding Apparatus

New "Fraser" multiple tissue-embedding apparatus provides a thermostatically-controlled electrically-heated constant-temperature bath with a tray



sectioned by dividers into 21 1.5-in. squares. Control within 0.5 C. ranging from room to 60 C. permits use of all types of embedding waxes and paraffins and insures bubble-free sections with proper surface faced to microtome cutter. It takes about 25 min. to embed 21 blocks, from pouring wax to trimming hardened blocks.—*Precision Scientific Co.*, 3737 *W. Cortland St., Chicago* 47, *Ill.*

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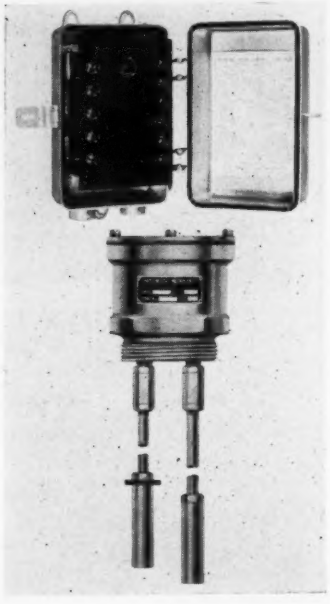
Liquid Level Controller

New "Type 10CB1" controls level of electrically-conductive liquids using stainless steel probe rods in contact with liquid. Probe circuit permits selec-



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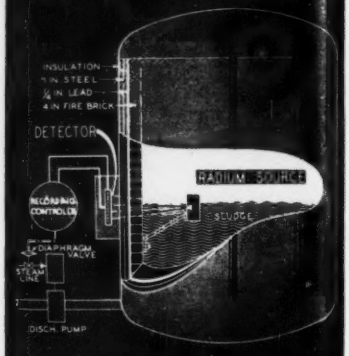

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tion from four sensitivity ranges. Control will discriminate between a liquid and its foam, and is not affected by saturated vapor above liquid in a closed tank.—*Photoswitch, Inc., 77 Broadway, Cambridge 42, Mass.*

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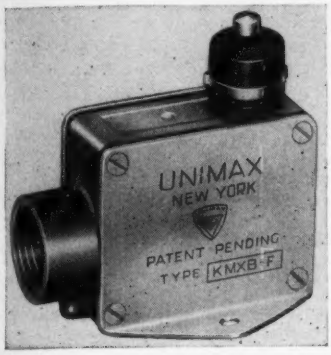
Splash-proof Precision Switch

New "Type KMXB" snap-acting precision switch uses neoprene boot and side gaskets to seal case against dust and liquids. Ambient-temperature range

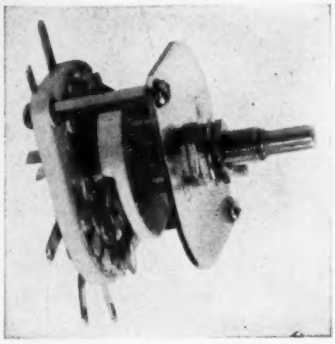


is from —65 to 160 F. Electrical ratings are from 20 to 5 amps. at 125 to 250-v. a.c. or 0.75 hp. at 125, 250 or 460-v. a.c. Case is tapped for 0.5 or 0.75-in. conduit.—*Unimax Switch Div., W. L. Maxson Corp., 460 W. 34th St., New York 1, N. Y.*

Mention No. 1019 when filling out card.

Selector Switches

New oval rotary-selector switches having from one to three poles per deck or gang offer as many as 18, 9



or 6 positions in single, double or triple-pole types respectively.—*Shallcross Mfg. Co., Collingdale, Pa.*

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Pressure Switches

New pressure switches are available with fixed or adjustable pressure settings. Switches are suitable for water level control in washing machines. A synthetic rubber diaphragm measures pressure, and operates a switch rated 6 amps., 120 v. a.c., s-p-.s-t. or s-p.d-t. Snap terminal connectors are rated 15

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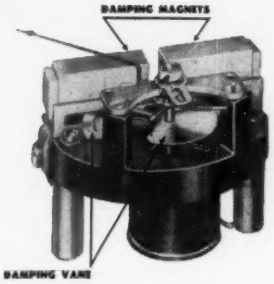

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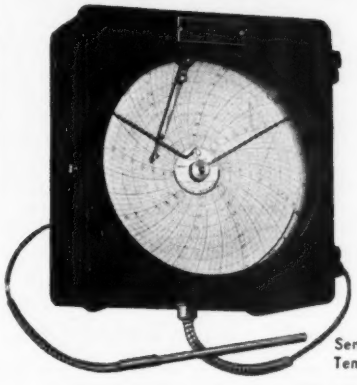

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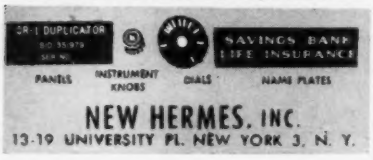

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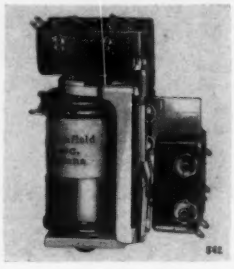
amps. Switch will withstand overload pressures of 10 psi. Pressure and differential settings are made by self-locking screws. Switch is approximately 3.25 in. diam. by 3 in. high.—*Soreng Mfg. Corp., 9555 Eden Ave., Schiller Park, Ill. (Chicago Suberb)*

Mention No. 1021 when filling out card.

Relay-and-Microswitch Units

New "Series MT" subminiature type telephone relays are now available with from one to four model 1SM1 microswitches. This gives an assembly with up to four 4-p.d-t. contacts, rated 5



amps., 115 v. 60 cps. resistance load, or 3 amps., 24 v. d-c. This relay is said to withstand more than 50g vibration. Coils are available for a-c. or d-c. operation. Relay may be used unhoused or hermetically sealed in a steel can with either plug-in or solder terminals. —*Potter and Brumfield, Princeton, Ind.*

Mention No. 1022 when filling out card.

Medium-mu Twin Triodes

New "5963 and 5964" medium-mu twin triodes are particularly designed for frequency-divider circuits as used in computing machinery. First is a 9-pin minature with mid-tapped heater to permit operation from either 6.3 or 12.6-v. supply, and separate terminals for each cathode. Max. plate dissipation is 2.5 watts. Second is a 7-pin miniature with a cathode common to both triode units. Max. plate dissipation is 1.5 watts.—*RCA Victor Div., Radio Corp. of America, Harrison, N. J.*

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Custom-built Delay Lines

New "lumped delay lines" are tailored to specific applications. A typical unit consists of eight pi-section low-loss filters having a rise time of 0.04 microseconds and a total delay of 0.3 microseconds. Maximum pulse voltage is 100 volts and impedance is 500 ohms. Cutoff frequency is 8.5 Mc. and maximum operating frequency is approximately 2 Mc. based on a pulse

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delay error of not more than 2%. Unit consists of eight universally-wound coils of 3-strand No. 41 Litz wire and nine low T.C. silver mica capacitors. Other types are available—*Shallcross Mfg. Co., Collingdale, Pa.*

Mention No. 1024 when filling out card.

Safety Clamp for Power Leads

New "Neg'ator" clamp for power leads is an application of negative-characteristic spring described in our August 1949 issue. It is available in

standard sizes covering a clamping pressure range from 2 oz. to 20 lb. in 8 increments. Coil diameters range from 0.5 to 2 in.—*Hunter Spring Co., Lansdale, Pa.*

Mention No. 1025 when filling out card.

Plug-and-Lamp

New "Model 1200" plug body is a nylon-housed screw-type electrical receptacle designed primarily for industrial uses. A built-in neon glow lamp

produces an easy-to-find light for speeding up operation and serves as a pilot to indicate the presence of power. It has a life in excess of 25,000 hours and uses less than 0.1 watt.—*Industrial Devices, Inc., Edgewater, N. J.*

Mention No. 1026 when filling out card.

Copper-oxide Rectifier

New "Model CX 18" copper-oxide rectifier is designed to obtain reverse resistance of over one megohm per plate. Unit is intended for circuits in

dependable instruments

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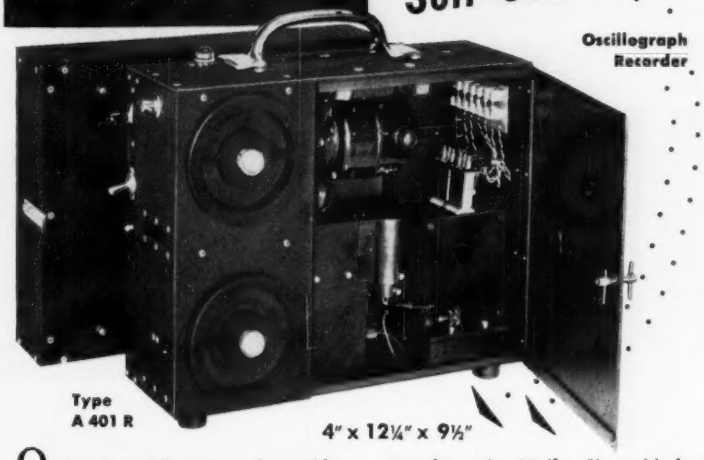

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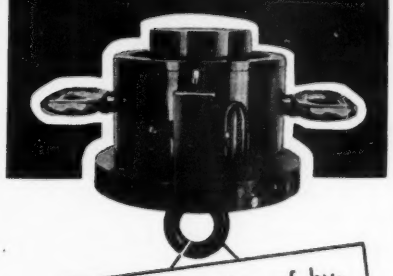

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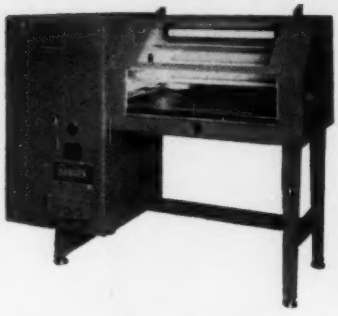

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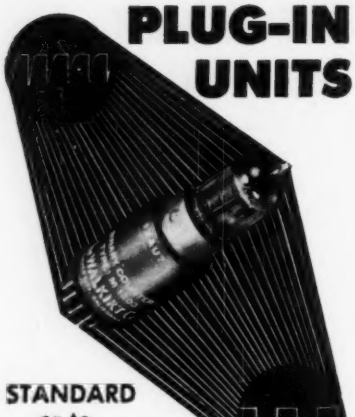

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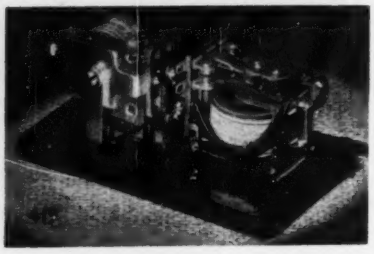
which low leakage and max. stability are essential. Max. load is 5 ma. Featuring vacuum processed-gold contacts, rectifier has 2.5 in. leads. Barrel is 0.725 in. long and 0.25 in dia.—*Bradley Labs., Inc., 82 Meadow St., New Haven, Conn.*

Mention No. 1027 when filling out card.

Latch-type Relay

New "No. 9061" latch-type midget relay is used where current is to be applied to coil momentarily, mechanical latch holding armature closed until

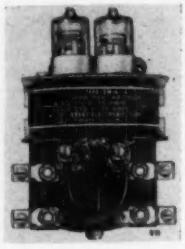


coil is energized. Contacts are rated 8-amp. 115-volts a.c. or 10-amp. 24-v. d. c. non-inductive, d-p. d-t. Coils are available for any voltage from 6 to 115 v. a.c., 50 to 60 cps., and 2 to 32 v. d.c.—*Leach Relay Co., 5915 Avalon Blvd., Los Angeles 3, Calif.*

Mention No. 1028 when filling out card.

Mercury Relays

New "Type EM-4" two-pole mercury-plunger relay handles loads up to 35 amp., 115 v.a.c. or 25 amp., 220 v.a.c. It is available with contacts n-o. or n-c. For special applications it has one con-



tact n-o. one n-c. Reliability lies in hermetic, dustproof structure, based on tungsten contacts in a hydrogen-filled glass tube. Contact is made from mercury to mercury when internal magnetic plunger is energized.—*Ebert Electronics Corp., 185-09 Jamaica Ave., Hollis 7, L.I., N. Y.*

Mention No. 1029 when filling out card.

Metallized-paper Capacitors

New line of capacitors using metallized paper is self-healing. Small size

and low r-f. impedance make units particularly useful for filter manufacture.—*Astron Corp., 255 Grant Ave., E. Newark, N. J.*

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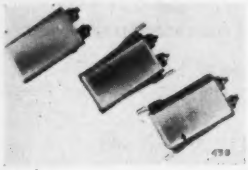
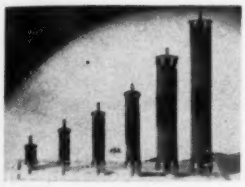


capacitors in same case. Capacitances can be furnished from 0.01 ufd. on up at 330-v. a-c. ratings or higher.—*Condenser Products Co., 1375 N. Branch St., Chicago 22, Ill.*

Mention No. 1031 when filling out card.

HV R-f. Capacitors

New "LSG" capacitors rated up to 25,000 v., working, are reported to cost



approximately 40 percent that of similar mica types—*Condenser Products Co., 1375 N. Branch St., Chicago 22, Ill.*

Mention No. 1032 when filling out card.

Rectifier Cartridge

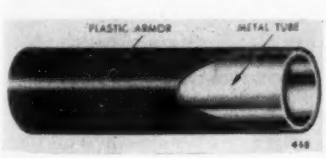
New rectifier cartridges are available in either phenolic, glass, or hermetically-sealed assemblies from 0.25 to 1.25 in. o.d., or can be built to individual specifications in half-wave or voltage-

doubler circuits. Illustrated rectifier is rated at 440 v., d.c. at 10 ma. with peak current of 120 ma. and a peak inverse voltage of 1500. Voltage drop is about 25.—*International Rectifier Corp., 6809 S. Victoria Ave., Los Angeles 43, Calif.*

Mention No. 1033 when filling out card.

Instrument Tubing

New "Dekoron" corrosion-proof instrument tubing made of metal with a 0.031-in. coating of extruded thermoplastic is immune to moisture, salt air,



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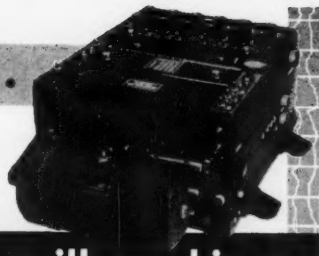

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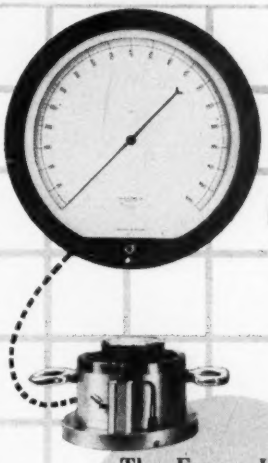

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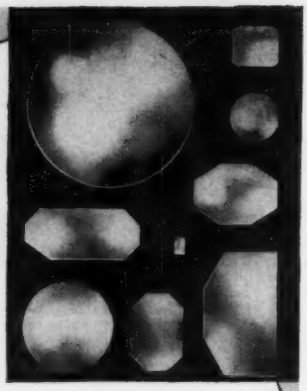

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oils, acids and alkalies. Available in 0.25 and 0.376-in dia., tubing can be bent easily, and plastic coating also serves as color coding for line.—*Samuel Moore & Co., Mantua, Ohio.*

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Aircraft Temperature-control Rheostat

New rheostat combines control-point selection for automatic heater or by-pass valves and manual override. Control point for automatic-valve operation is set on graduated dial. Valves of other

units can be manually positioned by detent-action switches at ends of rheostat travel. Setting is maintained by a vibration-proof friction brake. Single or tandem rheostats are available with max. resistance up to 3,000 ohms.—*Barber-Colman Co., Rockford, Ill.*

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UHF Filter

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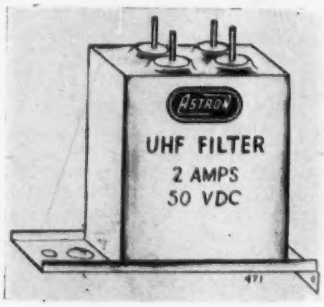

izes metallized paper to achieve small size in addition to self-healing ability.—*Astron Corp., 255 Grant Ave., E. Newark, N. J.*

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Fine-winding Resistors

New voltage-dividing resistors have exceptional precision, obtained by using ultra-fine wire having as many as 1000 turns per inch. One type uses wire approx. one-fourth dia. of a human hair. Resistors are used for such applications as translating mechanical into electrical amplitudes.—*The Gamewell Co., Newton, Mass.*

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Glass-sealed Connectors

New "GS"-type hermetically-sealed connectors are made with AN-type layouts in pin-contact arrangements.

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Shells and contacts are steel. Contacts are set in glass which is fused to both contact and shell. Units are adaptable to working temperatures up to 800 F.; meet salt-spray tests of 76 hours and thermal-shock tests.—*Cannon Electric Development Co., Div. Cannon Mfg. Corp.*, 3209 *Humboldt St., Los Angeles 31, Calif.*

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Pneumatic Hand Tool

New air-operated tool for crimping solderless terminals to wire is designed to combine advantages of power press with ease and flexibility of a hand tool.

Tool makes hand-pneumatic installation now possible in A.W.G. wire range 22 to 1 over 0.— *Aircraft-Marine Products Inc.*, 1568 *N. 4th St., Harrisburg, Pa.*

Mention No. 1039 when filling out card.

Conductivity Cells

New conductivity cells designed to withstand rough usage are constructed of 1 in. o.d. heat and chemical-resistant plastic with flush internal or external-ring electrodes. Available as wand type, dip type, or equipped with a threaded fitting for pipe installations, it can be supplied in constants from 0.010 to 20.0. —*Industrial Instruments, Inc.*, 17 *Pollock Ave., Jersey City* 5, *N. J.*

Mention No. 1040 when filling out card.

Conductivity Cell

New flow-type conductivity cell for ultrapure demineralized water is of heavy Pyrex-glass construction with sheet platinum electrodes. It is designed to operate as a continuous flow unit. Cell constant is 0.01 and is adapted for bridge and recorder ranges as low as 0-1 micromho.—*Industrial Instruments Inc.*, 17 *Pollock Ave., Jersey City* 5, *N. J.*

Mention No. 1041 when filling out card.

CORRECTION

In our July issue, page 697, sensitivity of the instrument described —Leeds & Northrup's "Stabilized D-c. Amplifier"—was incorrectly stated. Actual basic range, 0 to 50 or −25 to +25, is in *microvolts* and not mv. (millivolts).

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INSTRUMENTS ON THE MARCH

X-ray Microscope

SCHENECTADY, N. Y.—An x-ray microscope, which makes visible internal details of materials through which light cannot pass, has been developed by scientists of the General Electric Co. It was described by Miss Charlys M. Lucht, of the G-E Research Laboratory, at the recent Philadelphia meeting of the American Society for X-ray and Electron Diffraction.

Miss Lucht said that future refinements of the x-ray microscope, at present in the laboratory stage of development, may result in much sharper images and higher magnifications than are possible using visible light.

Miss Charlys M. Lucht, demonstrates an experimental x-ray miscroscope she developed in collaboration with other G-E scientists. On the far right, contained in a cylinder, is the x-ray source. The x-rays come from the aperture in the cylinder, pass through the sample, and are then magnified by two mirrors contained in the unit on which Miss Lucht's fingers rest. The magnified x-ray image is finally cast on a photographic film mounted behind the optical system to Miss Lucht's right.

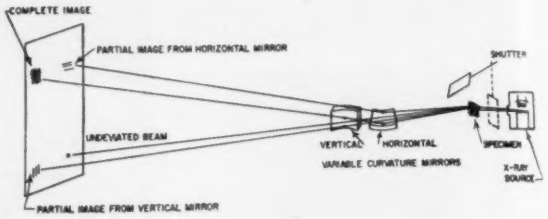
"The instrument may compete with electron microscopes in the future," she said. Electron microscopes are the most powerful magnifying instruments in use at the present time. They use a beam of electrons rather than light to form an image of materials under study. The x-ray microscope does not require that samples under study be in a high vacuum, as does the electron microscope. Because of this advantage, "it may be possible to examine living materials at much higher magnifications than ever before," according to Miss Lucht.

Clear, sharp x-ray images, magnified ten times, have been produced in the laboratory, and these images have been magnified ten times further by photographic enlargement without serious loss of detail. Thus, at the present stage of development, magnifications of 100 diameters have been produced.

Objects studied to date have been fine-mesh screens. Purpose of the studies has been to test the instrument's ability to reveal small details. Miss Lucht reports the results as excellent.

The microscope operates on the principle that x-rays can be reflected from polished surfaces, as can visible light, provided that they strike the surfaces at very small angles, almost parallel to the surfaces. It consists of an x-ray tube and a pair of curved mirrors, which the x-rays strike at an angle of less than one-half degree, after having passed through the sample. The mirrors, acting in a manner like that of a convex lens with a light beam, bend the rays in such a manner as to form a magnified x-ray image of the sample on a photographic film.

The mirrors are platinum-coated slabs of fused quartz, which are as nearly flat as surfaces can be made. They are curved by mechanical pressure, which can be adjusted by hand. This arrangement makes it possbile to change the mirrors' curvatures in order to improve focusing, Miss Lucht explained.



The optical system, sample holder, and dials for making focusing adjustments are mounted in a compact metal unit half as large as a shoebox. The unit is placed a few inches away from the x-ray tube, with the x-ray beam passing through the sample in its holder, thence to the mirrors, and finally to a photographic film located a foot or more away from the unit.

The unit and photographic film are mounted on a long wooden track, which runs parallel to the x-ray beam. The arrangement, which is purely experimental, enables Miss Lucht and her associates to move the optical system and the photographic film relative to each other, and relative to the x-ray source.

One-man Push-button Operation of Power Stations "Only A Dream"

NEW YORK CITY.—Although increasing costs of operating personnel are giving greater emphasis to centralized control, the dream of operating a steam-electric power station by one man sitting in a small air-conditioned office watching a single dial and twisting a single control handle to solve all operating problems is only a cartoonist's exaggeration, declared a speaker before the American Institute of Electrical Engineers.

B. C. Mallory of the Stone & Webster Engineering Corp., of Boston, Mass., explained why. For one thing, he said present-day equipment and controls are not sufficiently trouble-free, even with the best maintenance programs, and are not trusted to operate satisfactorily without adequate attention. "Nor," he said, "have automatic controls been devised to start either a turbine or a large high-pressure boiler from cold without manual assistance and careful checking by operators.

"The amount of advantageous centralization revolves about the number of manual controls that can be handled by one man in time of trouble," he continued. "One man can supervise many controls while everything is functioning properly, but in time of trouble the number and complexity of the controls that one man can handle depends to a large extent on the panel layout and the ability of the man."

Mr. Mallory described a recently constructed steam electric power plant with only two boilers and two generators in which a centralized panel control board was installed. The boiler control panels "of even this relatively minor arrangement," totaled 38 feet, and contained 84 indicators, 36 recorders, 12 controllers, 50 sets of start and stop switches with an average of 3 lights to a switch. The turbine panels totaled 26 feet and contained 14 indicators, 20 recorders and 16 sets of start and stop push buttons averaging 3 lights to a switch.

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"A vast amount of thought and effort should be applied to developing reliable controls for automatic starting of boilers and turbines," Mr. Mallory stated, "especially from an overnight standby condition. Managements are asking engineers to consider seriously some automatic time clock device, possibly with temperature- and vibration-sensitive adjustments, to coordinate starting procedures properly, both from the viewpoint of uniformity of operation and ease of control."

Mr. Mallory listed the following four points as major disadvantages of complete centralized control of steam-electric power stations with switchboards located in the control room:—

1. Space required for control room in heart of station. Adds to initial construction cost by adding building space and may add it for the full height of the station.
2. Each additional instrument and control adds equipment to be maintained and each is a potential source of trouble because it may function incorrectly.
3. Complexity of many instruments, controls, alarms and lights require a considerable training period for operators, especially if the mechanical and electrical men have to substitute for one another. With two mechanical men and one electrical man in a control room, this substitution might easily be required.
4. Added cost; due to either duplication of controls, or longer runs of instrumentation and control leads and the space required for them.

Mr. Mallory agreed, however, that the number of controls that one man may handle may be increased safely to some extent by logical arrangement and use of different types of control handles for different types of control, so that routine adjustments become simplified and, in emergencies, the operator acts from habit without having to think out each step of what he should do.

"There is a need," said Mr. Mallory, "for miniature mechanical instruments comparable to those on electrical boards or to those used for large airplanes. Furthermore, for ease and reliability of operation, the instruments and controls should be segregated to permit manipulating the vital controls from a central point with those having minor manual adjustments for efficiency and the historical items located at some less strategic point.

"The advantages of complete centralized control, with the switchboard located in the control room," Mr. Mallory continued, "include:

"1. Presentation of all pertinent data to one operator to give a better understanding of the plant as an integrated co-ordinated unit;
"2. Ability of operator to take corrective action simultaneously for two or more operations, should conditions demand;
"3. Avoidance of communication errors;
"4. Improvement in quality of operation (better operating conditions of the centralized control room attract higher type personnel.) This means more than better thermal efficiency as it should give better maintenance of load during upset conditions, quicker restoration after interruption, and better judgment in preventing an interruption;
"5. More automatic controls may be required, which tend to free the operator from details and permit more supervision."

EDITOR'S NOTE.—Our April 1950 cover photo showed the centralized instrumentation of the O. H. Hutchings Station of Dayton Power & Light Co., Dayton, Ohio, whereby one operator can have charge of the entire power-generating process "from fuel delivery to switchyard."

Advances in Diffraction-grating Production

BALTIMORE, Md.—Dr. John D. Strong, professor of physics at The Johns Hopkins University, and his research associates, have dealt another blow to the 19th century belief that "there are some things of which the human race must forever remain in ignorance." At the meeting of the Optical Society of America Dr. Strong announced his new machine for cutting diffraction gratings, important to science and industry, which will allow scientists to probe further into the mysteries of the universe.

Development of several of the component parts was done under the cooperation of the Office of Naval Research, through the Hopkins Institute for Cooperative Research. Hopkins provided the funds for construction of the machine.

Diffraction-grating machines are the most precise machines known to engineering science. The gratings have from five to thirty thousand equidistant lines per inch etched on glass which has been coated with aluminum. Precision

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can be understood when one realizes that this machine will cut twenty-five absolutely straight lines, equidistant to a millionth of an inch, on the straight edge of a cigarette paper.

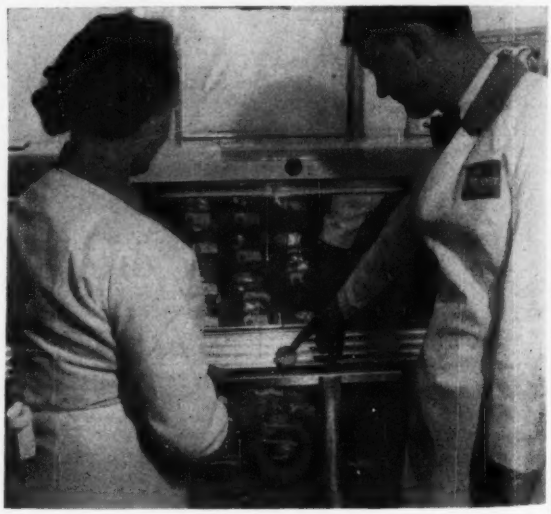
Successful diffraction gratings were first ruled in 1880 by the late Dr. Henry A. Rowland, first professor of physics at The Johns Hopkins University, on a machine which has been the model for all grating machines until the one just designed by Dr. Strong and his associates at Johns Hopkins. Previous to 1880, spectrum analysis was done by using prisms which are more costly than the diffraction gratings. Although a few machines were modeled after the Rowland machine, the greater percentage of grating over 4 inches in length used throughout the world have been produced at Johns Hopkins. Six days were required to cut one grating.

Dr. Strong's new cutting machine will produce gratings up to six inches in length in three days. The added speed gained by the new machine will make it possible to come nearer to satisfying the urgent demand of scientific laboratories and industrial plants waiting their turn to secure a six-inch grating from Hopkins.

The cardinal feature of the new design is the use of two precision lead screws to advance the diamond ruling cutter, with exact precision, as the diamond moves across the surface to be marked.

In addition, it was announced that Dr. Strong's machine is designed to serve as a pilot model, from which grating machines can be made to produce gratings up to 24 inches, with each line 12 inches long. Dr. Strong said: "Our new machine contains new mechanisms which will allow us to create larger machines which we believe will function perfectly in cutting gratings larger and larger until we reach a size needed by scientists and production engineers in their work of exploring fields of science and technology which have hitherto been closed to their researches."

The diffraction grating is credited in all scientific circles with contributing more than any other one single piece of equipment to the rapid progress of modern physics. The new machine will aid in opening new frontiers of science. Its use was responsible for advances in modern science. Examples are: the discovery of thirteen of our known chemical elements; specific discoveries in chemical analysis; allowed scientists to gain precise information about the electron structures of atoms and provided our first information about the physical properties of the nucleus of the emitting atom; gave the astronomers *all* of their vital information about the constitution of heavenly bodies.



Customers of a new Kroger supermarket in Toledo, Ohio, can see for themselves that meat in the refrigerated self-service counter is kept at the proper temperature, thanks to specially installed thermometers, manufactured by The Electric Auto-Lite Company of Toledo.

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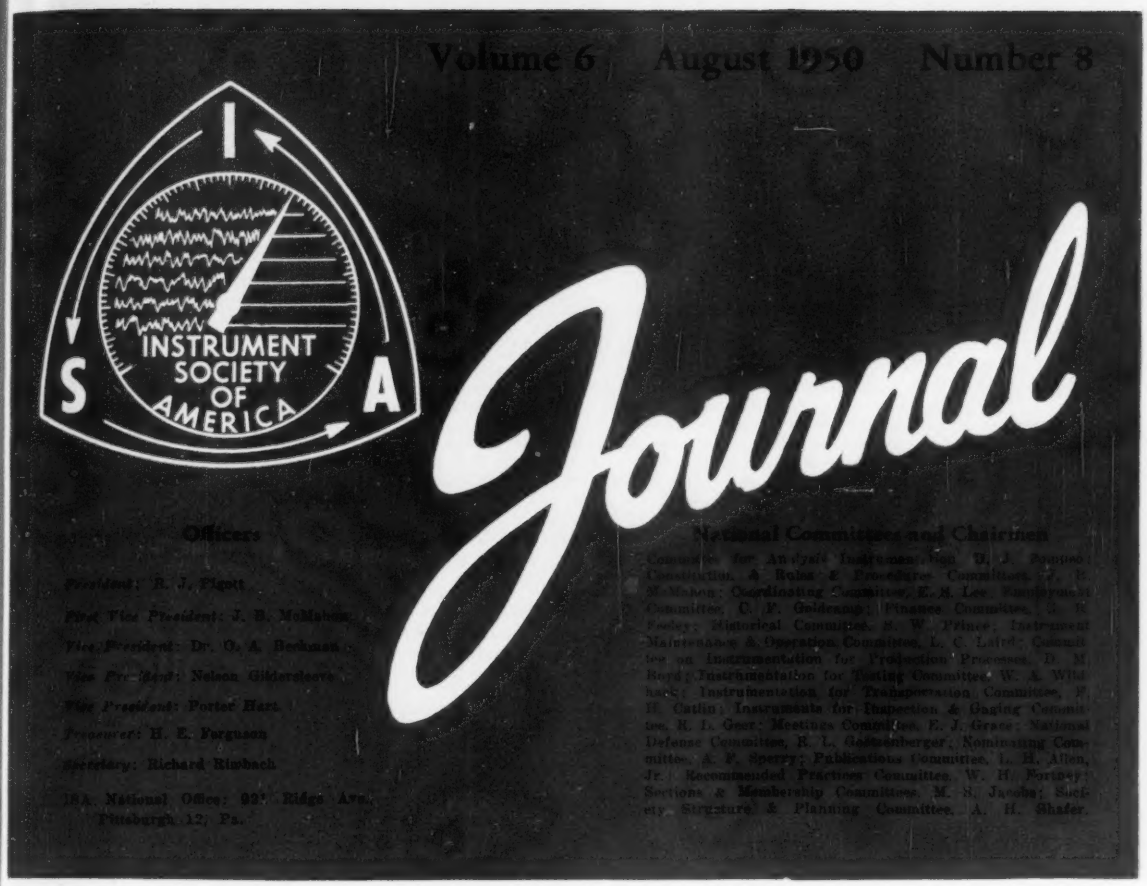

EDITORIAL

THE ISA JOURNAL

WITH this issue, we are introducing a new ISA Journal format of improved appearance and definite identity as an ISA publication, including several new features which will provide more information on the activities of the Society and its National Officers. In subsequent issues, additional features will be added and every effort will be made to constantly improve this publication in order that it may more nearly meet the requirements of the membership.

LYMAN ALLEN, JR.

Of specific interest to each member of the Society is the report of the Special Publications Policy Committee which is published on the following pages. The National Executive Committee in their meeting in Houston, Texas on June 20, 1950, approved the recommendations of this committee and requested the Publications Committee to immediately place the recommendations in effect. Your Publications Committee is anxious to give the ISA membership a Journal of which they can be proud. Constructive suggestions for the improvement of the publication and comments on the report of the Special Publications Policy Committee will be very gratefully received at the National Office. The help of all members is needed if we are to succeed in publishing a noteworthy Journal.

AN ISA TECHNICAL PAPER

One of the principal objectives of the Instrument Society of America is to advance the theory and practice of Instrumentation, and one of the foremost ways in which the Society pursues this aim is through the sponsoring, presentation, and publication of technical papers on this subject. At each annual national meeting, fifteen to twenty and possibly more technical papers on various aspects of Instrumentation are presented by the members of the Society in an effort to further the knowledge of other members interested in the fields covered by the papers. These Technical Sessions are an extremely important activity of the Society and, as such, demand the support of each and every member. Therefore, we wish to appeal to all members to support the Technical Papers program of the Society through the preparation of technical papers which may be presented before one of our national meetings.

Of equal importance to the paper, itself, is the necessity of preparing it in accordance with the format accepted by the Society and the adherence to the Society's schedule for submittal of the paper in order that it may be properly reviewed, preprinted and included in the program. Each year the Society has had considerable difficulty in obtaining final copies of the papers scheduled for presentation at the national meeting in time to properly process them. This year the delay has been so serious that it may be impossible to prepare a complete program of the Technical sessions and preprints.

It is absolutely imperative that all papers be received by the Vice President in charge of the Technical Committees at least ninety days in advance of presentation. Failure to meet this deadline can only result in some sacrifice which will detract materially from the value of a paper. Therefore—*authors take note*—please do everything possible to submit your paper promptly in correct format, complete with abstract and all other required information. You will thus assure the proper handling and presentation of your paper.

Respectfully,

LYMAN ALLEN, JR., CHAIRMAN
The Publications Committee

THE SECRETARY'S PAGE

Richard Rimbach

See you in Buffalo. Please say "Hello." If I seem to be running around in circles, please remember that I AM running around in circles.

I'd like to remember the name of each of our 4300 members but I can't. Wear your badge and I'll keep my eyeglasses polished. If there is anything I can do to make your attendance at the National Instrument Conference and Exhibit more profitable and pleasant, by all means, get in touch with me.

Report of the Special Committee on the I.S.A. Journal

By LYMAN H. ALLEN, JR.

AT THE July 16, 1949 meeting of the Executive Committee of the I.S.A. the writer was requested to accept the Chairmanship of a special committee to study I.S.A. Publication Policy. In its study, the Committee was requested to give special reference to the Journal, and to recommend to the Society a definite publication policy the administration of which would make it possible for I.S.A. Publications to more nearly meet the requirements of the membership. In considering the problem placed before this special committee the writer felt that the committee's problem was one which should be solved through comments and suggestions received from the various Sections of I.S.A. This would permit development of an I.S.A. publication policy which would meet with the approval of the membership at large. Therefore, it was decided that the membership of the new special committee should consist of one member from each I.S.A. Section, that member to be appointed by the Section President. Since it would be nearly impossible to bring all of the members of such a committee together for a meeting, transacting of business by mail was felt to be the most satisfactory way to handle this committee's activities. Therefore, the writer, acting as chairman of the committee, made a study of correspondence and memoranda pertaining to the past publication policy of the Society and the editing of the Journal. The following recommendations for improving the situation have been prepared.

I.S.A. Journal

In covering the subject of the I.S.A. Journal, it should be noted here that the Instruments Publishing Co. now pays for the following services in connection with the publication of the Journal:

1. Setting of type
2. Cost of engravings
3. Make-up
4. Proof Reading
5. Printing and paper
6. Editorial work at $10.00 per page.

The estimated cost of the above services including item (6) is $70 per page or a total of $6650.00 for the total of 95 Journal pages printed in *Instruments* during the year 1948. The Society paid the Instruments Publishing Co. for 4000 subscriptions at $1.50 each or a total of $6000.00. A check on these costs may be obtained from the estimate of $1000 per issue for a separate journal of 16 pages submitted by Mr. Frost. This is equivalent to a per page cost of $62.50. A further check made with the American Institute of Chemical Engineers who publish *Chemical Engineering Progress* showed approximately the same cost.

From the above study it would seem that the I.S.A. is receiving full value for money paid to the Instruments Publishing Co. and the responsibility for failure of the *JOURNAL* to meet the requirements of the I.S.A. membership lies in I.S.A. publication and editorial policy.

Separate Journal

Since the opinion that the I.S.A. should publish its own Journal has been expressed many times, this subject has also been investigated.

A contact was made with the American Institute of Chemical Engineers who started publication of their magazine *Chemical Engineering Progress* in 1947. At that time, they allotted an appropriation of $55,000 to cover the expenses of introducing this new magazine.

At the end of 1949, the third year of publication, the magazine was still operating "in the red" and cash on hand had dropped to $9,000. Cost of operation, for 1949, was $150,000. Of this cost, $83,000 covered publication, while the balance of $66,000 covered the cost of operation and advertising. Receipts for 1949 were $65,000 from subscriptions and $81,000 from advertising, for a total of $146,000. From the above data, representing recent experience in the introduction of a new magazine, it is obvious that such an endeavor is a costly one. Should the I.S.A. decide to publish their own Journal they should make available a sum of $80,000 to $100,000 for that purpose. A good portion of this sum would be spent without return during the planning period of 6 months to one year necessary to set-up the organization which will be required to operate the magazine. The present financial condition of the I.S.A. could certainly not justify the publication of an independent journal by the Society. It is, therefore, recommended that we continue with our present arrangements which call for the incorporation of the I.S.A. Journal in *Instruments*.

Journal Format

Assuming that the I.S.A. Journal will continue to be published in *Instruments*, the following changes in format are recommended:

1. The pages of the Journal should be press perforated and punch marked to facilitate removal for insertion in the I.S.A. binder.

2. The pages of the Journal should be numbered separately from the pages of *Instruments*.

3. The first page of the Journal section should be a cover sheet, in the upper center of which should appear the I.S.A. symbol. A list of I.S.A. National Officers should appear in the upper left corner and a list of major committees and chairmen in the upper right corner. The lower half of the page should present a table of contents for the particular issue. (See front cover). Color can be added at a cost to the Society of $60.00 per issue, per page.

4. The inside of the front cover should contain a Section directory giving the name of each Section, the name and address of its (president and) secretary, and the usual meeting time and place.

5. The monthly feature articles should start on page three and actual text should preferably be preceded by a 50 to 100 word abstract of the article printed in heavy face type. A picture of the author (s) may be printed in the upper left corner.

6. Following the feature article a section of news items of National interest contributed by Sections and members should appear.

7. The following new features should be incorporated in the Journal:

a. "Secretary's Page", containing National Society news, list of new members.

b. "Personal Notes", news about members, changes in position, achievements, etc.

c. Placement announcements.

Journal Editor

As previously noted, the Instruments Publishing Co. pays the Society $10.00 per page for material printed in the I.S.A. Journal. It has been the practice of the Society to pay this same amount to the Society-appointed Editor to cover his services and expenses. This represents a cost of approximately $1000 per year. This expense can be eliminated by giving the editorial responsibility to the Chairman of the Publications Committee and eliminating the position of "Editor," who has reported to the Publications Committee. An appropriation of $500.00 per year should be granted the Publications Committee to cover its expenses. The savings can be used to buy more Journal space in *Instruments*. Mr. McCaffery in the National Office should be appointed "News Editor" in charge of the news sections of the Journal, reporting to the Publications Committee. Each Section should appoint an "Assistant News Editor" who should submit section news of National interest to Mr. McCaffery. Mr. Richard Rimbach should be appointed an ex-officio

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member of the Publications Committee in order that his experience and advice may be available.

I.S.A. Proceedings

Since the "Proceedings" so far published have contained papers which have been previously published in the Journal its value has not been great. Since the recommended press perforation of the Journal pages will permit easy removal of printed papers from the magazine for filing, the value of the Proceedings will further diminish. Therefore, it is recommended that its publication be abandoned at a savings of approximately $1,000.00 per year to the Society. Some of this savings can be used to buy more Journal space in *Instruments* as the need is indicated.

Year Book

It is recommended that the Society publish a "Year Book" at two-year intervals. This publication should contain the following:

1. A list of Officers and Committee Chairmen.
2. Constitution & By-Laws.
3. Alphabetical list of members with home address, company and Section affiliation.
4. A list of Sections in the order in which they were granted charters, their president and secretary, usual meeting place and time.

The "Year Book" should be prepared by photo offset in a form suitable for insertion in the I.S.A. Binder and should be made available to members on written request.

Instructions to Authors

It is recommended that the I.S.A. publish its own "Instructions to Authors" rather than use the "ASME Instructions to Authors" booklet as has been our past practice. A copy of this instruction booklet should be forwarded to each prospective author. The I.S.A. should insist that all manuscripts be submitted in accordance with a standardized format in order to facilitate processing.

Preprints

If at all possible, all papers presented at National Conferences should be preprinted. Preprints should be sold at a price sufficient to cover the cost of preparation. A list of preprints available and their respective prices should be published in the Journal before and after each National Meeting.

Recommended Practices Reports

Recommended Practices Reports should be published as released by the Vice President in charge of the Technical Committees and approved by the Society.

Approval for Publications

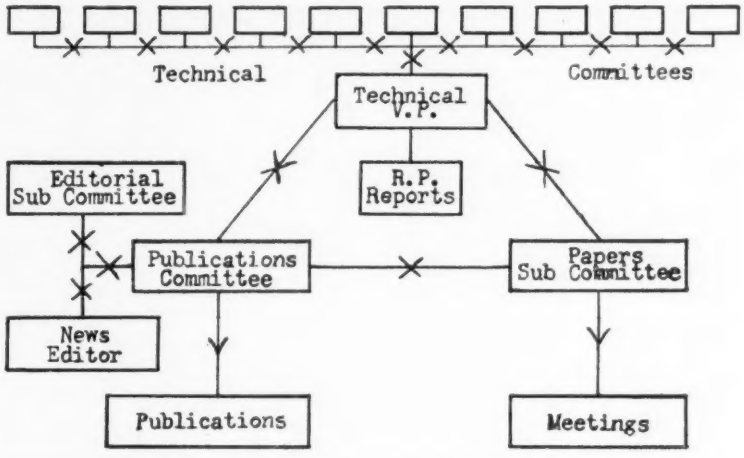
With the exception of Recommended Practices Reports all other material must be approved by the Publications Committee before publication. All technical papers must be approved for technical contents by the Vice President in charge of the Technical Committees before they can be considered for publication by the Publications Committee. Approval of a technical paper by the Vice President in charge of the Technical Committees should commit the I.S.A. to presentation of the paper at an annual meeting and to publication. In reviewing a paper for publication approval, the Publications Committee will concern itself only with the form, terminology and grammatical corrections of the paper.

Technical Papers

It is the responsibilty of the Vice-President in charge of the Technical Committees to furnish all technical papers required for presentation before annual meetings of the Society. In order to improve the present situation, however, it is strongly recommended that the Technical Vice President appoint a Papers Committee which, while working under his direction, can relieve him of much of the actual work of obtaining the required papers. It would be the responsibility of this new Committee to arrange the technical program for annual meetings, solicit papers from the various Technical Committees and outside authorities, and to keep after each author in order that the various necessary deadlines may be met. If a proper job is done by this Committee it should be possible for the Society to receive papers in ample time to permit proper handling for approval by the Technical Committees and the Publications Committee, for preparation preprints, and scheduling for presentation.

1. All papers must be approved by Technical Division before presentation at a national meeting and/or publication.
2. All papers presented at national meetings will be preprinted and sold at cost.
3. The Papers Committee will supply the papers required by the Meetings Committee for national meetings by:
   a. Obtaining as many papers as possible from the Technical Division.
   b. Obtaining the balance required from I.S.A. members or outside sources.
4. The Technical Vice President will supply the papers required by the Publications Committee from papers presented at national meetings.

ORIGIN AND ROUTING OF PAPERS



Report of the ISA Nominating Committee Meeting

of June 3, 1950, Chicago, Illinois

By A. F. SPERRY, Committee Chairman

The meeting was called to order by Chairman Sperry at 10:00 A.M., June 3, 1950. The following were present: R. R. Proctor, A. F. Sperry, A. P. Harmon, W. H. Brand, C. F. Gardner, E. H. C. Brown, M. S. Jacobs, J. W. Head and George Ehly. Absent: J. W. Graeb, W. E. Boyle, T. H. Pierson and G. F. Rucker.

The roll call shows that 31 Sections had personal representatives at the meeting, while 17 Sections were not personally represented. Almost all of the larger Sections were represented and those at the meeting agreed that a very substantial quorum was present. (Representing approximately 70% of the Society's members)

Unfortunately not a single Section west of the Mississippi was represented personally, but telegrams or letters were received by the Chairman from *all* Sections so that it was possible to give weight in the discussion to the opinions of the entire membership of the committee.

In our memorandum of May 26, 1950, twelve names were listed as candidates for the various offices under consideration.

A. V. Novak and J. G. Kerley sent word through their representatives that they could not accept nomination for office at this time due to the press of other duties, and their names were removed from consideration.

The name of Dr. A. O. Beckman was also listed as a candidate for president in this May 26th memorandum. However, the chairman was notified by wire that Dr. Beckman's acceptance was contingent upon the condition that J. B. McMahon did not accept. Therefore, during the meeting the chairman called Dr. Beckman by telephone. When informed that Mr. McMahon was actually in a position to accept the nomination, and his company approved and backed his position, Dr. Beckman asked that his name be removed from consideration, since he felt that Mr. McMahon's long record of activity with the I.S.A. made him an ideal candidate for the office.

Before balloting, all the letters and memorandum from the members not present were read and discussed. One of the Sections suggested that a ballot be taken for a final selection by the nominating committee. In view of the

fact that a very large majority of the membership was represented, it did not seem to the committee that the taking of a ballot could possibly influence the decision.

The following names were unanimously nominated:

President—J. B. McMahon, Republic Flow Meters Co., Chicago, Illinois; Vice Pres.—W. A. Wildhack, National Bureau of Standards, Washington, D. C.; N. L. Isenhour, Carbide & Carbon Chemicals Corp., Oak Ridge, Tennessee; Treasurer—George Feeley, Trinity Equipment Corp., Roselle Park, New Jersey; Secretary—Richard Rimbach, Instruments Publishing Co., Pittsburgh 12, Pa.

In connection with Dr. A. O. Beckman's candidacy, the committee felt very strongly that his services to the I.S.A. were of such a nature that the Executive Committee would suffer a loss if he could not continue with them for at least another year. It realized that at the last meeting of the directors in St. Louis, it was decided that the Executive Committee be limited to the officers of the society and the past president. After considerable discussion the nominating committee unanimously decided to recommend to the Executive Committee that this practice be modified so that past officers of the society, or at least out-going officers, would not be included in this motion. It was felt that there is a considerable difference between a man who has served actively as an officer and a man who is new entirely to the Executive Committee. The following is therefore offered purely as a recommendation for the I.S.A. Executive Committee and Board of Directors:

That Dr. Beckman be elected to serve on the Executive Committee for at least one more year.

Another question came up regarding the possibility of nominating committee members being proposed as candidates for office and it was felt that a policy should be adopted that would clear up this question which has caused confusion in the past. It was therefore unanimously recommended that the following be considered by the Executive Committee and the Board of Directors as I.S.A. policy to cover this:

If a member of the nominating committee permits his name to be put up, he shall immediately withdraw from the nominating committee entirely, relinquishing his position to his alternate on all matters dealing with the nominating procedure. He shall not attend any nominating committee meeting during which he is being given consideration.

It should be noted that this same policy has been recommended by previous nominating committees and it is hoped that some action will be taken to clarify the work of the committee.

More emphasis should be placed in selecting members of the committee on their agreement to attend the meetings. Those present at the meeting realized that only a round-table discussion could give members of the committee a true picture so that they could form well rounded opinions. As soon as any member finds that he will not be able to attend a meeting, he should proceed at once to find another director in his group or in an associate group who can represent him at the meeting and who knows his point of view.

W. A. Wildhack Appointed Chief of NBS Basic Instrumentation Office

On June 1, 1950, there was established, in the Director's Office of the National Bureau of Standards, the Office of Basic Instrumentation. W. A. Wildhack, member of the Washington Section of ISA, was appointed chief. This Office will administer a program of basic instrumentation research supported by interested Federal Agencies. This program, which is an extension and an enlargement of a project now carried on in cooperation with the Office of Naval Research, will involve:

1. Systematic and comprehensive analyses of available methods and devices for laboratory and field measurements of physical magnitudes in terms of their limitations in precision and reliability.

2. Initiation of work on problems dealing with materials, components, and elements, associated with more or less broad classes of instruments or devices for measurement and control.

3. Initiation of work leading to development of new or improved instruments for specific purposes.

The functions of the Office of Basic Instrumentation will include: (a) general coordination of Bureau projects in basic instrumentation, maintenance of liaison with sponsoring agencies, and the arranging for cooperative work or special problems; (b) maintaining continual survey work in progress in NBS laboratories with regard to its pertinence and applicability, direct and indirect, to existing or proposed projects of instrumentation, and facilitating the availability of such information, and consulting services on instrumentation problems, to Government agencies and their contractors; (c) arranging for the testing and evaluation of new instrument developments on a continuing basis and stimulating or directing experimental study of significant developments in instruments, instrument components or materials originating elsewhere; and (d) stimulating and directing theoretical and experimental studies of original ideas for improved or novel means of measurement not specifically covered by other projects.

Mr. William A. Wildhack, presently Chief of the Missile Instrumentation Section, will serve as chief of the new office. He has been with the Bureau since 1935, working in the fields of aeronautical, mechanical, and electronic instruments. He received a B.S. in electrical engineering (1931) and an M.S. in physics (1932) at the University of Colorado, and taught physics and mathematics at that university, at Boise Junior College, and at George Washington University. As a member of the Mechanical Instrument Section, he developed design formulas for corrugated diaphragms, widely used in pressure-measuring instruments, and contributed extensively to the development of oxygen equipment for high altitude flight. He has invented a number of devices relating to liquid oxygen equipment, respiratory apparatus, dynamic measurement of flow and temperature, and electrical gaging.

Mr. Wildhack has had numerous papers published in scientific periodicals in the fields of instrumentation, electrical polarization, stellar energy, parachuting, and fluid flow. His professional activities include serving as Councillor of the Washington Section of the Instrument Society of America, Chairman of the Committee on Scientific Equipment of the National Research Council, and Associate Editor of the Review of Scientific Instruments.

Last year Mr. Wildhack attended the National Conference on Measurements and Instruments in Stockholm, Sweden, as a guest of the Royal Swedish Academy of Engineering Sciences and delivered the opening address entitled, "Instrumentation—Common Denominator of the Sciences." He was subsequently awarded the silver medal of the Academy.

Recently he visited research laboratories and scientists in England, France, and Italy as consultant on scientific equipment to the Economic Cooperation Administration.

D. M. Boyd Granted Degree

David M. Boyd, Instrument Engineer for Universal Oil Products Company, Chicago, a member of the Chicago Section of ISA, was granted the Degree of Chemical Engineer from the University of Colorado on June 10, 1950. This advanced professional degree was awarded to him for his development work on the graphic instrument panel and the paper he authored, "Process Control by Graphic Panel."

At present he is serving as chairman of the ISA Production Processes Committee. He is also a member of the American Institute of Chemical Engineers and American Chemical Society.

ISA Speakers, Motion Picture Lists Available

Program Chairmen, Section Presidents, and other Section Officers who are now making arrangements for their 1950-51 Section meeting programs are invited to write to the National Office and request the "Possible Section Speakers List." This is a ten-page list of 110 talks presented before ISA Sections. The speaker's name and address, the title of his talk, the Section before which the talk was presented and the date of presentation are listed. This list, compiled by the National Office for the benefit of the Sections, was assembled from meeting announcements received from the Sections.

Also available is a five-page list prepared and distributed through the courtesy of the General Engineering and Consulting Laboratory of the General Electric Company. It includes the names of 87 available speakers with the titles of their talks.

The attention of Program Chairmen is also directed to the availability of the "ISA Motion Picture List." This is an eleven-page listing of 43 motion picture films available for sale or on loan to ISA Sections. The listing of each film title is followed by a review of its contents; a description of its size, color, running time, etc.; its availability and from whom it may be obtained.

Those interested are urged to write for these three lists to aid them in their program selections.

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Movie of Control Demonstration Prepared for I.S.A.

WHEN you see the movie "Principles of Automatic Control" at the Fifth National Instrument Conference and Exhibit in Buffalo, it may appear that the demonstration was filmed impromptu at one of the lectures given by Messrs. Akins and Kowalski. This is far from the case. A considerable amount of work was required to organize and film some 38 separate scenes that could be edited to produce smooth continuity in the final product. Many interesting facts regarding technical difficulties in filming the demonstration are now available for publication.

As contrasted to the usual industrial movie showing a process in operation, the simultaneous recording of picture and sound to reproduce a demonstration offers far greater problems along technical lines. For instance, the normal industrial film can be made in two steps by first recording sound then shooting the picture to agree with the narration. A carefully prepared script can be read by a narrator in a sound studio and the record made on sound tape. The recording can be taken on location and played back numerous times to establish the desired camera shots and to rehearse the actors (usually production operators), in the action they are to provide. No sound recording difficulties are encountered since machine noise need not be recorded.

As a comparison, the shooting of one short scene of the control demonstration required several hours of preparation and rehearsal. First, the action and general effect of the scene were studied and planned for the best camera angle. Flood lights and spots had to be placed to avoid shadows and reflected light. In many cases the glass had to be removed from dials and gages to prevent glare. To capture details of small parts an occasional close-up was sandwiched into the scene but to avoid multiple camera set ups, the close-ups were made hours after shooting the main scene.

When lights, camera and action were satisfactory, a sound level and voice test had to be made. At this point the technical difficulties multiplied greatly. For instance, the air compressor for the demonstration panel had to be moved outside the building to avoid noise interference. This necessitated long connecting lines to the panel. A small pump supplying water to the equipment had to be mounted on sound isolation strips and all water lines discharging into a sump tank were baffled with cloth. Otherwise, the combined sounds would have practically blanked out the narrator's voice. Other minor noises, such as A.C. hum from lights, electrical interference between power cords and sound equipment, external sounds such as trucks, trains—even the cackling of chickens on adjacent property—all had to be avoided during the shooting of the scene. As could be expected, several scenes were ruined by the passage of a heavy truck or by the blast of a railway whistle some distance away.

When all tests and rehearsals were found satisfactory, the scene, lasting some 50 seconds, was filmed. For some scenes the ratio of preparation time to actual shooting time was easily one hour per minute of finished film.

To complete the studio work on schedule it was found necessary to work long hours over a four day period. A continuous run of 15 hours was made on the last day of filming.

Considerable preparatory work was required to adapt the demonstration for filming. The script was revised to delete minor details and thereby reduce the running time to one hour. To replace the usual black board diagrams, colored charts and sketches were made on a special grey cardboard suitable for color photography. White paint is objectionable in color films, hence the entire panel and related parts were repainted a light grey. Air tubing and water piping were color coded to increase the effectiveness of the assembly. A small amount of blue dye was added to the circulating water for greater visibility.

To illustrate a typical recording controller, yet avoid the use of a specific manufactured item, a special dummy case was fabricated from plywood and pressed board. The general arrangement of the chart, control adjustments, and air gages was purposely made to differ slightly from the current popular designs. This item proved to be a source of humor—since the case contained nothing more than a chart holder, fake gages, and adjustment knobs that regulated nothing—the remark was made that it represented the ideal instrument—no maintenance ever required.

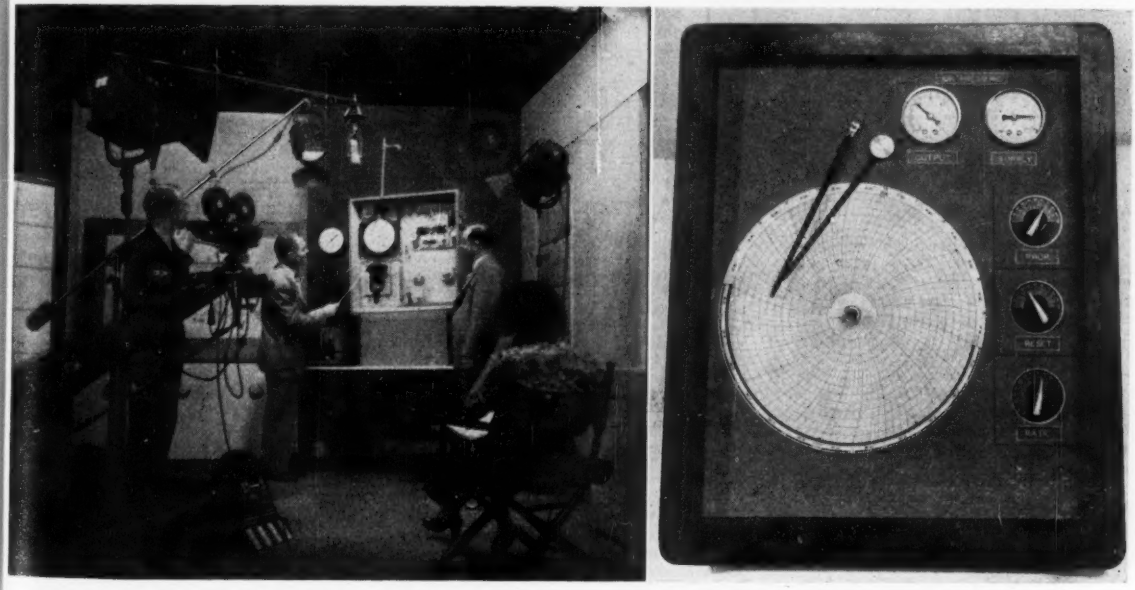
One unusual fact concerning the production was that all narration, with the exception of the opening and closing paragraphs, was done ad lib by Mr. Akins. While this simplified the rehearsal of scenes, it did present difficulties in the final editing of sound and film because of the lack of precise written material to establish sequence of scenes.

A few interesting figures concerning the making of the movie have been collected in tabular form.

Time of preliminary preparation .. (Script, drawings, props, etc.)	100	hrs.
Man hours required at studio .... (5 persons, each 40 hours)	200	hrs.
Total man hours	300	
Total scenes taken	38	
Number of re-takes	4	
Total footage of film used	2700	ft.
Final finished footage	2100	ft.
Final running time	55	min.

While the production was purposely kept on an amateur plane, it is believed that the essentials of the demonstration have been clearly presented without the use of expensive animation, paid actors, or a large staff of studio workers. The film should prove very helpful in presenting the subject of automatic control to students, technical personnel, instrument mechanics, production supervisors and operators.

This movie can be shown by the Sections of the ISA by writing to the Na-



Left.—Scene in McLarty studio during filming. Right.—"Ideal" instrument built by "Flower City Instrument Company."

tional Office for scheduling. It also will be made available to other societies and schools.

Copies of the film can be purchased by companies for their own training programs. Be sure to see the film, it will be shown each afternoon, Monday through Thursday at Buffalo.

Employment Committee Preliminary Report

Following is a report prepared by C. F. Goldcamp, National Employment Committee Chairman submitted to Nelson Gildersleeve, Vice President, Membership Relations Division, and presented at the Executive Committee Meeting of June 19, 1950.

The following Sections are represented on the Employment Committee:

Akron	Cumberland	Philadelphia
Albuquerque	Eastern N. Y.	Pittsburgh
Baltimore	Louisville	Richland
Baton Rouge	Montreal	Sarnia
California	New Jersey	St. Louis
Boston	New York	South Texas
Central Ind.	Niagara Frontier	Southern Mich.
Charleston	Northern Ind.	Twin Cities
Chicago	Oak Ridge	Wayne County
Cleveland	Ontario	Washington

Thirty Sections are represented as compared to fourteen Sections on the Committee in September 1949. This is an excellent response and indicates increasing Section interest in the activities of the Society.

THE EMPLOYMENT SERVICE

Registered Applicants: (members only as of June 1, 1950)

Class A Graduates of Technical Institutions	24
Class B Instrument Technicians and Mechanics	33
Class C Students	—
Class D Manufacturers' Reps., Salesmen, etc.	4
Total all registered applicants	61

This represents a decrease of 27.5% from September 1, 1950.

Open Positions

Open positions announced in the Journal of the ISA and applications received by months:

Month	*Positions*	*Applications Received*	*Av. applications per position*
October 1949	12	72	6.0
November 1949	5	27	5.4
December 1949	9	36	4.0
January 1950	10	47	4.7
February 1950	4	18	4.5
March 1950	4	16	4.0
April 1950	9	30	3.3
May 1950	7	23	3.3

The average applications per position index shows a steady decrease in men seeking employment. The appreciable decrease in the number of those seeking new employment and the fact that only one is registered as being unemployed, indicates a very healthy condition in the employment status in the instrument fields.

Of the 60 positions listed, 14 were filled by ISA members through the Employment Service; 5 by non-members through the Employment Service; 4 by non-members through an agency other than the Employment Service. The remaining 37 prospective employers made no report on outcome of their advertisement. Of the five non-members employed through the Employment Service, three are now members.

Section Secretaries, Meeting Data and Programs

AKRON
Fred Appel, 932 Columbia Ct., Barberton, Ohio. Tel: SH 3440
Fourth Tuesday, Meeting at 7:30 P. M., Akron Y.W.C.A.

ALBUQUERQUE
E. J. Burda, Sandia Corp., P. O. Box 5800, Albuquerque, N. Mex.
First Monday, Meeting at 8:00 P.M., Science Lecture Hall, Univ. of N. M.

ARUBA
K. H. Walker, P. O. Box 389, c/o Lago Oil & Transport Co., Ltd., Aruba, N.W.I.
First Tuesday, Meeting at 7:15 P. M., Engr's Club.

ATLANTA
H. Kockritz, Fischer & Porter Co., 84 Peachtree St., Atlanta, Ga. Tel; CY 1269
Fourth Monday, Meeting at 7:45 P.M., Ga. Institute of Technology.

BALTIMORE
George B. Greer, 631 E. 36th St., Baltimore 18, Md. Tel: Chesapeake 6879
Second Friday, Meeting at 8:00 P.M., Engr's. Club of Baltimore.

BATON ROUGE
John Q. Bass, 1517 Longwood Dr., Baton Rouge, La. Tel: 3-0283
Meeting monthly, no definite time, L.S.U. Physics Bldg.

BOSTON
Stephen E. Lord, 60 Braintree Ave., Quincy 69, Mass. Tel: MA 9-1066
Last Wednesday, Dinner at 6:30 P. M., Meeting at 7:00 P.M., 99 Club.

CALIFORNIA
D. C. Duncan, Helipot Corp., 916 Meridian Ave., S. Pasadena, Calif. Tel: SY 4-8439
Second Wednesday, Dinner at 6:30 P. M. Meeting at 8:00 P.M., Carolina Dines.

CENTRAL ILLINOIS
Thomas A. Carroll, 721 Hurlburt St., Peoria 6, Ill. Tel.: Peoria 4-8909
First Wednesday, Dinner at 6:30 P.M., Meeting at 7:30 P.M.

Employment Committee Activity

The one special activity of the Employment Committee during the 49-50 meeting year was an endeavour to compile a directory of employers of instrument men. The response by Sections to this endeavor has not been good but a few did make an all out effort to cooperate and to date we have a list of over three hundred names of individuals who are directly responsible for the employment of instrument men.

The following members of the Committee are deserving of special mention for their effort in compiling this list: L. J. (Buddy) Lynch, South Texas; John C. Steven, Charleston; Roy Johnson, Chicago; Howard Hobbs, Sarnia; Murray Smith, Eastern New York.

EMPLOYMENT SERVICE

Forward your letter to INSTRUMENT SOCIETY OF AMERICA, 921 Ridge Ave., Pittsburgh 12, a.

INSTRUMENT ENGINEER. Excellent opportunity in well known oil refinery company for graduate chemical engineer. Must have heavy experience in oil refinery instrumentation. Will prepare process control diagrams and specifications for purchasing and installing of instruments. Give details and experience in first letter. Box 319.

INSTRUMENT MECHANICS by large manufacturer of Chlorine and Caustic Soda, and Chlorinated hydrocarbons, especially benzine. Must be experienced in process instrumentation. Forty hour week, $1.77 per hour. Location Natrium, W. Va., thirty miles south of Wheeling, W. Va. Write for employment application. Box 320.

INSTRUMENT SALES ENGINEER. Graduate C. E. or M. E. Experienced in process equipment. 30 to 40 yrs. of age. For Ass't. to Dist. Mgr. of Pittsburgh District. Excellent opportunity. Give complete resume in first letter. Box 321.

CENTRAL INDIANA
H. F. Coffey, 4029 N. Temple Ave., Indianapolis, Ind. Tel: HU 5832
First Tuesday, Meeting at 7:30 P. M.

CENTRAL NEW YORK
Karl W. Robertson, Minneapolis-Honeywell Reg. Co., 121 W. Onondaga St., Syracuse, New York.

CHARLESTON
Clayton A. Williams, 303 E. 9th St., Belle, W. Va. Tel: 927871
First Monday, Dinner at 6:30 P.M., Meeting at 8:00 P.M., Kanawha Hotel.

CHICAGO
Floyd E. Ertsman, Rm. 1420 Fisher Bldg., 343 S. Dearborn St., Chicago, Ill. Tel: WE 9-0686
Third Tuesday, Dinner at 6:30 P. M., Meeting at 8:00 P.M.

CHINA LAKE
A. H. Staud, 1004 Michelson Lab., USNOTS, China Lake, Calif. Tel: 77882
Fourth Thursday, Meeting at 8:00 P.M., Michelson Lab, USNOTS.

CINCINNATI
Edward H. Muhleisen, 320 Durrell Ave., Cincinnati 15, Ohio. Tel: PO 1168
First Monday, Meeting at 8:00 P.M., Eng'r. Society Hqs.

CLEVELAND
A. E. Ehrke, 1732 East 291st St., Wickliffe, Ohio. Tel: WI 3-1036
Fourth Wednesday, Dinner at 6:30 P.M. Meeting at 8:00 P.M., Cleveland Eng'r. Society.

COLUMBUS
W. C. Myers, c/o Battelle Memorial Institute, 505 King Ave., Columbus, Ohio. Tel: UN 3191, Ex. 248
Third Thursday, Meeting at 8:00 P.M., Battelle Auditorium

CUMBERLAND
Clyde Babst, 225 Cecilia St., Cumberland, Md. Tel: 583-W
Tuesday after Fourth Monday, Dinner at 6:30 P.M., Meeting at 8:00 P.M., Algonquin Hotel.

DETROIT
Seymour Sterling, 13331 Linwood, Detroit, Mich. Tel: Tyler 5-1707
Second Wednesday, Meeting at 8:00 P.M., Rackham Bldg.

EASTERN NEW YORK
W. R. McKegg, c/o Gen. Engrg. & Consulting Lab., G. E. Co., Schenectady, N. Y.
First Tuesday, Dinner at 6:30 P.M., Meeting at 8:00 P.M.

GULF COAST
W. N. Sloan, E. I. Du Pont de Nemours & Co., Orange, Texas. Tel: 8411 Ext. 444
Third Tuesday, Meeting at 7:30 P.M., Lamar College.

HOUSTON
I. K. Farley, 2123 Travis St., Houston, Texas.
Last Monday, Meeting at 8:00 P.M., Engineers Club.

KANSAS CITY
L. E. Oberhelman, Standard Oil Co., Sugar Creek, Mo. Tel: MU 1227
First Tuesday, Meeting at 7:30 P.M., Univ. of Kansas City.

LOUISVILLE
H. C. Scherffius, 980 Palatka Rd., Louisville 8, Ky. Tel: Franklin 1265
Fourth Tuesday, Meeting at 8:00 P.M., Seagram Auditorium.

MONTREAL
S. J. Mizuhara, 1075 Allard, Verdun, Quebec, Canada. Tel: TR 3252
Last Monday, Meeting at 8:00 P.M. Mechanics' Institute.

NEW JERSEY
Fred L. Crabbe, 41 East 42nd St., New York 17, N. Y.
First Tuesday, Dinner at 6:00 P. M. Meeting at 8:00 P.M., Essex House.

NEW ORLEANS
W. H. Haney, 2927 Music Avenue, New Orleans, La.
No Regular Date, Meeting at 8:00 P.M.

NEW YORK
F. B. Leslie, 8856 Commonwealth Blvd., Bellerose 6, N. Y. Tel: FI 7-0645
Last Monday, Dinner at 6:00 P.M., Meeting at 7:45 P.M., Henry Hudson Hotel.

NIAGARA FRONTIER
Mrs. James L. Martin, 697 Potomac Ave., Buffalo 9, N. Y. Tel: GR 1450
Fourth Monday, Dinner at 6:00 P.M., Meeting at 8:00 P.M., Institute of Arts and Sciences, Buffalo.

NORTH TEXAS
R. E. Byers, 6000 Lemmon Ave., Dallas 9, Texas

NORTHERN CALIFORNIA
M. A. Dimmick, 5607 Alta Punta, El Cerrito, Calif. Tel: Be 5-1095
Third Monday, Meeting at 7:30 P.M., Angelo's, Emeryville.

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MAINTENANCE OF PRESSURE GAGES

By ROBERT F. ANGELL and JAMES HAYS,
Los Angeles Refinery, Union Oil Company of California, Wilmington, Calif.

INTRODUCTION

THIS article deals with the practical aspects of the maintenance of pressure gages in an oil refinery. W. feel that the proper maintenance of pressure gages begins with proper Selection, Standardization, Installation. These points will be discussed first. It is not the intention of this article to explain the actual details of repairing and testing gages.

The maintenance of pressure gages is merely incidental to the primary task of the measurement of pressure. It must always be kept in mind that maintenance is not merely repairing and testing gages in a shop, but fundamentally to make it possible and convenient for an operator to measure pressure accurately at all points in his plant. This is necessary for him to operate his plant safely, correctly, and efficiently.

We feel that the following three questions should be answered in the minds of anyone first, before repairing, reading or working with pressure gages.

What is Pressure? The term Pressure as we use it in this industry refers to fluid force per unit area and is expressed in pounds per square inch (psi.). By fluid we mean liquids, gases, or vapors.

Why do we measure Pressure? The proper and safe control of fluids in vessels and the control of flow in pipe lines necessitates using pressure gages for control. Other types of control are temperature, liquid level, rate, and composition (by laboratory tests).

How do we measure Pressure? A simple Bourdon tube is the most common method of measuring pressure. Most devices for measuring pressure are based upon the principle that a curved metallic tube changes shape (tends to straighten out—so as to equal the forces on all walls), when the pressure within the tube becomes greater than the pressure outside the tube. This straightening out effect is transmitted to gears through a link mechanism and is made to indicate on a scale or record on a chart.

Other types of mechanical devices for the measurement of pressure are the helical tube, the spiral tube, the diaphragm, and the bellows.

(The "U" tube manometer containing a liquid is perhaps the oldest and simplest method of measuring pressure, but it is not in the scope of this article.)

The "lowly" indicating pressure gage is so common, so taken for granted, and so simple in operation that its importance is often overlooked.

This refinery has approximately 3400 indicating gages of the 4½ in., 5 in. and 6 in. size; approximately 400 regular instrument-board-mounted gages. This does not include recording gages or all of the 2½ in. 0-30-psi. gages used in connection with air transmission instruments and on diaphragm-motor valves.

The measurement of pressure is an important function of any instrument department, and methods of testing, repairing, and maintaining pressure gages is essential.

PROPER SELECTION AND STANDARDIZATION

Each instrument board-mounted gage must necessarily be considered as an individual problem and the following notes do not necessarily apply.

Flush-mounted gages of the 6-in. or 8-in. size are usually selected for board mounting. The range and make considered individually from a standpoint of symmetry, ease of reading, etc.

For the numerous "run-of-the-mill indicating gages used on towers, pumps, and other equipment around a refinery the following remarks apply.

The 4½-in. or 5-in. gage is the heaviest gage which can be safely supported on a ¼-in. pipe connection.

Use bronze tube gages on all steam, water, and air service. Use bronze tube gages with any other fluids if advisable from a corrosion standpoint and if fluid is non-inflammable.

Use steel tube gages with all hydrocarbons. This includes all petroleum liquids, all fuel gases and oil vapors.

A gage range should be selected so that the normal working range is between 40 and 60 percent of the maximum range of gage. A minimum number of ranges which will cover the needs should be selected and standardized on and carried in stock for quick installation or replacement.

We have selected the following ranges to cover our needs and these gages are carried in warehouse stock. Every effort is made to confine our requirements to these standards. It is sometimes necessary for us to ignore the recommendation above which recommends keeping the working range between 40 and 60 percent in order to adhere to our range standards.

Bronze Tube Gages	*Steel Tube Gages*
30 in.— 60 psi.	30 in.— 100 psi.
0 — 30 psi.	0 — 30 psi.
0 — 100 psi.	0 — 100 psi.
0 — 200 psi.	0 — 200 psi.
0 — 300 psi.	0 — 300 psi.
0 — 600 psi.	0 —1000 psi.
0 —1000 psi.	0 —3000 psi.

Chemical Gage (Diaphragm Type)
0—300 psi.

There is no such thing as an all-purpose gage. After standardization, select the gage for the particular job with care.

INSTALLATION

After the proper gage is selected, the installation is important.

The gage should be reasy to read. Place it so that it can be read from the normal standing position. Place it so that it can be read while standing on a defined walkway or platform. If gages are in close proximity, they should be selected so the major and minor divisions are similar and installed so that they do not invite mistakes in reading. Some gages are divided in 5-psi. minor divisions, some in 6-psi. minor divisions. Two gages like this together invite mistakes in reading.

They should be installed safely. If the vibration is great it will be necessary to brace the gage piping. Acid or caustic gages should be definitely

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LOUIS J. DELANEY
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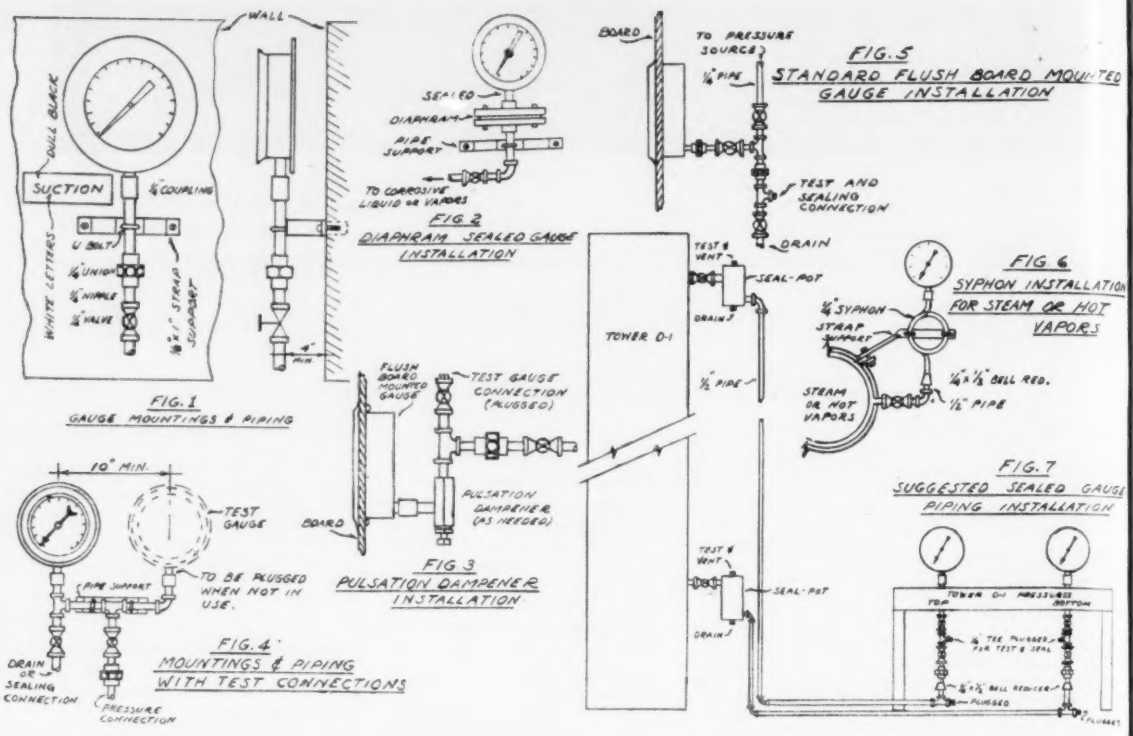
*Presented before the Southern California Meter Association.



marked. They should be installed with convenient and safe shut-off valves so that they may be safely and readily removed for checking or replacement.

They should be installed to protect the gage from damage. Often, ten dollars spent for a gage and thirty or forty dollars for its installation is good economy. If pulsation is great, some type of pulsation damper is necessary. If the fluid whose pressure is to be measured is corrosive, a seal or protector should be installed. Always use gage syphons where it is possible for steam or liquids over 200 F. to get into the Bourdon tube. Gages should be installed so that they give the correct reading. We advocate pressure connections out the *side* of the pipe for all liquids; pressure connections out the *top* of the pipe for all gases. One exception; if a gas or vapor gage is to be sealed because of considerable condensate forming in the gage piping, we prefer the pressure connection to be on the side of the pipe, or on the horizontal.

If a liquid pressure is desired on a tower or a pipe line, it is necessary to install the gage at this point, or at a point in the same horizontal plane, in order to get the correct pressure. If this cannot be done, an error due to the difference in elevation between the pressure connection and the center of the gage exists. Many times a pressure on the top of a tower is desired at the bottom of a tower or in a control room. The error due to the liquid head can be computed, and a correction to the gage reading applied or the pressure gage can be compensated for this error. This is accomplished by resetting the pointer on the gage, to read the same as the reading of a test gage at the pressure connection. Our practice is to use air transmitters on pressure points of importance where large compensations would be necessary.

Pressure-gage piping should include convenient points for draining the liquid from the piping, and for installing a test gage, and for resealing the gage piping.

We have some installations where the gage piping is quite long and the gage connection is at a much higher plane than the gage. For these installations we advocate ½-in. piping and a seal pot at the pressure connection. The piping and seal pot to be filled with water, or in some cases 50 percent water and 50 percent glycerine. This liquid is pumped into the piping and up to the seal from a connection in the piping near the lower gage. This system insures a definite hydraulic head which does not easily change and can be readily compensated for.

Checking

Before checking of a pressure gage, one must decide what accuracy is needed or desired. Commercial accuracy usually means plus or minus 1 percent of total range within the middle 60 percent of the range, and plus or minus 2 percent at the lower and upper portion of the scale.

It is readily possible to calibrate most gages to higher accuracies, and for shop testing and for all gages used in test work or precise work we require accuracies at least 100 percent better than the above. Gages are not always discarded if they cannot be readily calibrated to the normal accuracies required, but are often used at less important places and set correct at the normal operating pressure and are definitely marked on the face of the gage as to the limit of accuracy.

The checking of pressure gages may be accomplished by comparison or by checking against a dead weight.

Pressure gages are often tested in the field by comparison to a test gage. A test gage or master gage is a gage which has been carefully checked in the shop and frequently rechecked and is carefully handled and never left in use for long periods without rechecking. It may be a specially constructed gage with many fine divisions or may be one of your best stock gages properly marked for quick identification.

A gage may be checked in the field by the following procedure:

First: Read the gage to be tested.
Second: Remove gage, install test gage and again read.
Third: Reinstall gage being tested and again read.

From the above observations and the action of the gage pointer going up and down, you should be able to decide whether the gage needs to be taken to the shop.

All instrument-board gages and firmly-mounted gages should be installed with test gage connections in the rear of the board or at a convenient location. This makes possible the reading of both gages at the same time. It is also possible to compare the gages at several pressures, by shutting off the pressure and allowing the pressure in the two gages to drop to some convenient readable pressure, by draining

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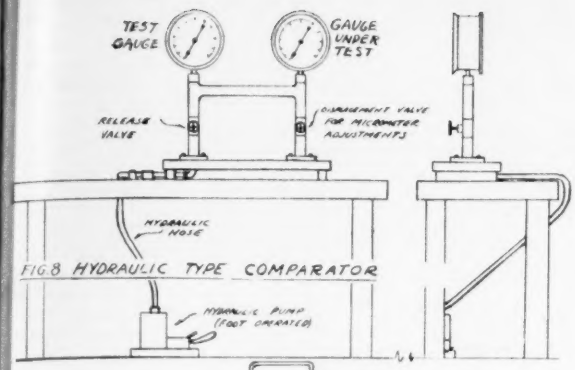
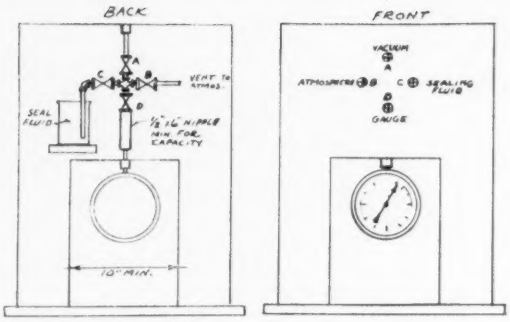


FIG.8 HYDRAULIC TYPE COMPARATOR



DIRECTIONS:

1. CLOSE B & C. OPEN A & D.
2. EVACUATE SYSTEM.
3. CLOSE A & OPEN C.
4. REPEAT STEPS 1 & 2
5. AFTER REPEATING THREE TIMES, GAUGE SHOULD BE SEALED. PROVIDE DRIP POT TO CATCH OIL AT GAUGE OPENING WHEN REMOVING GAUGE
6. OPEN B BEFORE REMOVING GAUGE

FIG. 9. GAUGE SEALING DEVICE

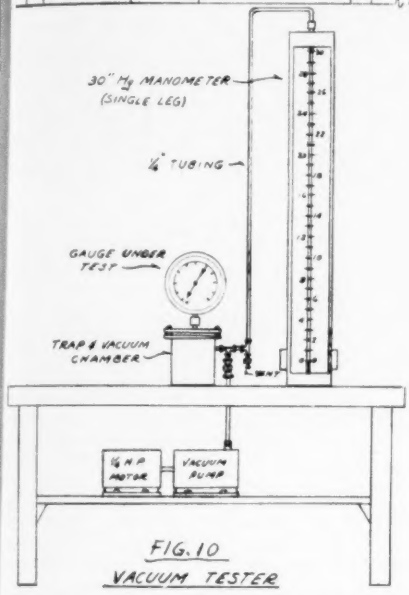


FIG. 10
VACUUM TESTER

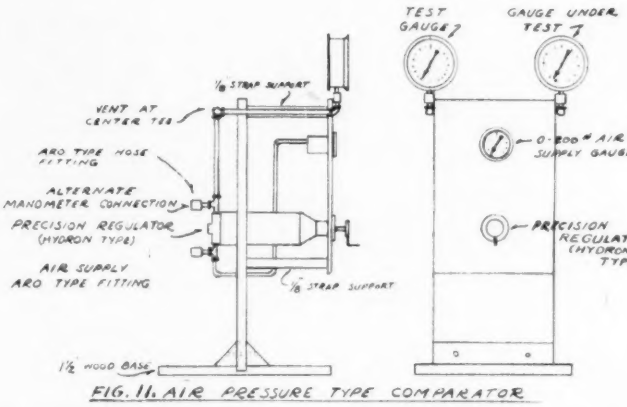


FIG. 11. AIR PRESSURE TYPE COMPARATOR

some of the fluid from the piping of the gage side of shut-off valve.

Gages are tested in the shop by means of a dead-weight tester or a comparator. If a gage appears to need a complete overhaul and re-calibration we send it to the dead-weight tester bench. Gage comparators are shown in Figs. 8, 10 and 11. Gages under 100 psi. are compared to a master gage with an air pressure tester. Higher-range pressure gages are compared to a test gage with a hydraulic pump type of tester.

PRESSURE GAUGE REPORT

Size_____ Type_____ Make_____

Range_____ Serial No._____

OBSERVED READINGS		Corrections to be applied to gauge
Test gauge or tester	Gauge to be tested	

Date tested_____ Tester_____

Foreman_____

FIG A

Calibrations are shown on forms similar to Fig. A.

All gages that are tested or repaired and recalibrated in our shop are painted before sending out or storing. Besides reading correctly, a gage must be easy to read, look neat and clean and inspire confidence in the person reading it.

Gages that need a complete overhaul are dismantled and the parts cleaned, then reassembled and recalibrated on a dead-weight tester. Two testers are usually needed, one with a range of weights up to 500 psi. and one with a range of weights up to 5000 psi.

Repairing and Recalibrating

Practically all gages that need repairing need recalibration. Repairing consists mostly of replacing broken hair springs, worn gears, links, bearings, and bearing screws. It is generally our practice to salvage the parts of a gage with a ruined Bourdon tube. We have found it cheaper to buy a new gage than to have a large stock of Bourdon tubes on hand. We prefer to make one good gage out of two bad gages, and to stock assembled gages instead of parts. We do stock new hair springs, pointers, bearing screws, links, and complete movements. We salvage these parts and also tubes, rims, and dials from dismantled gages.

It is simple to replace a Bourdon tube and this is what we do if we have one among our salvaged parts and if the other parts of a gage are good. We cut all of our glass fronts with a circular glass cutter of the glass-board and handle type. We clean, re-paint, re-silver, or replace gage dials, depending on the one most economical.

After the gage has been cleaned and reassembled and worn parts replaced with new or salvaged parts, and the hair spring has sufficient tension to take up all lost motion from minimum to maximum travel of the pointer, recalibration begins.

The gage is set up on a dead-weight tester with the dial and pointer removed, and some type of rough marking on the case indicating the mid-point reading of the dial, the 20 percent of maximum dial reading and the 80 percent of maximum dial reading. Weights are placed on the platform of the tester equal to 20 percent of maximum dial reading, and the pointer set on hand tight for this reading.

By applying weights on the platform and observing readings at mid-scale,

and at 80 percent of maximum reading, it can readily be determined whether the mechanism must be adjusted to make the pointer move faster or slower or whether an angularity adjustment must be made. These are the only two adjustments in the works that can be made. To adjust for *multiplication* or pointer travel, it is merely necessary to adjust the movement or sector sliding arm, to make the pointer move faster or slower. *Angularity* adjustment is made by changing the relation of the sector to the pinion gear. This is done by lengthening or shortening the connecting link or by rotating the movement.

We always instruct our beginners at gage testing on these two adjustments and on hair-spring tension, and then request them to familiarize themselves with these adjustments by trying many different adjustments on the same gage and observing the results. A little practice with these adjustments makes it posible to make them quickly, and without too many attempts. With these two adjustments it is possible to calibrate a gage correctly over the entire scale.

After the gage is adjusted to read correctly at three points with the dial off, it should again be tested with the dial on and with the glass front on.

Tools Needed

All of our instrument men who are apt to be confronted with gage jobs in the field are furnished with a gage pointer remover or hand jack, a gage set and a test gage in addition to their regular kit of instrument tools.

Beside the necessary testers, test gages and fittings to adapt all gage connections to the testers, the following tools are desirable at the gage bench.

Hand jack.
Hand set.
Four-ounce ball-peen hammer.
Two pairs of tweezers for work with hair springs.
Orange sticks for cleaning bearings.
Pipe cleaners and brushes for cleaning.
Small jeweler's anvil.
Set of small needle files.
Soldering torch and electric soldering iron.
Jeweler's vise or small machinist's bench vise.
Small hand vise.
Set of jeweler's screw drivers.
Regular screw drivers and pliers.
Long-nose pliers.
A shop-made device for removing difficult rims.
Circular glass cutter and straight glass cutter.
Bottle of glass cleaner with sprayer.
Set of pin vises.
Set of pin punches.
Yankee hand drill.

Drill press and grinder and buffer is for use by the entire instrument personnel.

Storing Gages and Storing Parts

To test and repair gages efficiently, the mechanic should have a convenient workbench, at which he can sit on a stool with a back rest and with ample knee room. The light should be correct and tools and parts within easy reach. A bench with parts drawers, similar to a jeweler's bench, but on a larger scale, would be desirable. Our gage department consists of a U-shaped bench with parts drawers and cabinets below and with all of the various testers at different points on the bench ready for use after removing a canvas cover. The weights are in racks in the rear of each of the testers, at an easy arm's reach. Parts are kept in small parts drawers, each drawer being properly labeled. At one end of our gage testing department we have a metal-covered soldering bench with all the necessary accessories in drawers and cabinets below.

The cleaning of dirty gages and the painting of gages is done outside of the regular gage department.

We have tried many ways of storing finished tested pressure gages. Gages carried in warehouse stock are stored on shelves in boxes. Gages that are in rotating use in the refinery are hung on metal hooks on wall boards over the gage bench. These gages are arranged in rows, designating ranges, and whether steel or bronze tubes. The mechanic testing gages can see at a glance which ranges are needed and what his stock of tested gages consists of. Gages to be repaired and tested are kept in cabinets below the bench in stacks of similar ranges. Every effort is made to keep the gage bench clear of everything except the equipment mentioned and the one gage that is being worked on.

Conclusion

As has been pointed out, each pressure gage installation should conform to certain standards. However, each job must be treated individually, considering safety, accuracy, ease of reading, care of gage and economy. The accompanying sketches on suggested installations may be of helpfulness. The accompanying sketches on suggested test equipment were intended for those desiring to build their own equipment.

Give the "lowly" pressure gage "a break." Select it properly, install it correctly, service it periodically, and it will give years of satisfactory service.

TECHNICAL SOCIETIES

PITTSBURGH DIFFRACTION CONFERENCE

Plans are being formulated for the Eighth Annual Pittsburgh Conference on X-ray and Electron Diffraction, to be held on November 2 and 3, 1950 at the Mellon Institute for Industrial Research, Pittsburgh 13, Penna. Papers are invited. Titles should be sent to the Chairman of the Program Committee, Dr. L. J. Hofer, Bureau of Mines, Bruceton, Pa. before August 15, so that a preliminary program may be published.

—C. W. Cline, Chairman, Publicity Committee, Aluminum Research Laboratories, Box 772, New Kensington, Pa.

PACIFIC ELECTRONIC EXHIBIT AND I.R.E. CONVENTION

LONG BEACH, Calif.—The Sixth Annual Pacific Electronic Exhibit, to be held in the Municipal Auditorium, Long Beach this coming September 13-14-15, will house the largest and most diversified display of electronic materials and equipment ever shown in the West at one time, taxing and housing capacity of the Auditorium. All industry admitted free by registration. The Annual West Coast Convention of the Institute of Radio Engineers will be held at the same time, same place.—Heckert Parker

HYDRAULICS CONFERENCE

CHICAGO—The sixth annual National Conference on Industrial Hydraulics will be held October 18 and 19 at the Sherman hotel in Chicago. Sponsors of the non-profit, non-commercial technical conference are Armour Research Foundation of Illinois Institute of Technology and the Graduate School of the Institute, with the cooperation of seven Chicago technical societies.

SOCIETY FOR APPLIED SPECTROSCOPY

The September meeting of the Society for Applied Spectroscopy will be held Tuesday the 12th: 6:00 p.m., informal dinner, Tosca's, 118 Fulton Street, New York. No reservations necessary. 8:00 p.m., business meeting, Socony-Vacuum Training Center, 63 Park Row, N. Y. There will be no formal speaker, but plans for the coming season will be outlined by the new officers and committees. A social hour will follow, including "coffee and cake."—Charles H. North

COVER PICTURE STORY

This month's cover picture is a view in the "instrument bank" of the new John T. Ryan Memorial Laboratory of the Mine Safety Appliances Co., Pittsburgh, Penna., dedicated June 14, 1950. The list of instruments, as supplied by the company, follows:

Ammeters and voltmeters—accuracy 0.5 percent (Weston Electric Instrument Co.)
Instruments for general experimental set-ups—accuracy 2 percent
Multitesters—for measurement of voltage, current and resistance in several ranges (Rawson, Vomax, Reiner and Radio City)
Vacuum-tube voltmeters
Wide-range beat-frequency oscillator.—Generates frequencies from 50 cps. to 5 Mc. with measurable amplitude
Impedance bridge—For measurement of resistance, capacitance and inductance (Brown Engineering Co.)
Operadio audio amplifier
General Radio capacitor boxes—range 0.1 microfarad to 11.1 microfarad
Wheatstone bridge—for resistance measurements from 0.001 ohms to 1,000,000 ohms
Resistance boxes (Leeds & Northrup)
Portable potentiometer—for checking and calibrating instruments (Leeds & Northrup)
Null detector and amplifier—for frequency measurements 50 cps. to 10 kc. per second (General Radio Corp.)
Power supplies—regulated low voltage 250 volts 80 ma.
Audiometer—hearing test (Sonotone Mfg. Co.)
Audio signal generator—for generating signals 20 cps. to 20 kc. with measurable amplitude (Hewlett-Packard)
Audio-frequency oscillator—generating signals 0.5 to 50,000 cps. (Hewlitt-Packard)
Oscillograph—for viewing alternating current wave forms (Radio Corp. of America)
Electronic switch—enables two signals to be applied simultaneously to the input circuit of an oscillograph (Dumont Lab)
High-precision thermal a.c.-d.c. voltmeter—4 ranges 0.5 to 20 volts (Weston)
"Strobotac"—speed measurements up to 14,500 r.p.m. (General Radio)
Thermal conductivity meter (Engelhard)
High-precision portable potentiometer—for calibrating and checking instruments (Leeds & Northrup)
Oxygen meter—0-800-mm. partial pressure of oxygen (Pauling Instrument)
Ampere box—for calibrating ammeters with potentiometer (Leeds & Northrup)
Volt box—for calibrating voltmeters with potentiometer (Leeds & Northrup)
Communications receiver—frequency range 0.55 to 43 Mc. (Hallicrafters)
Slide-wire rheostats

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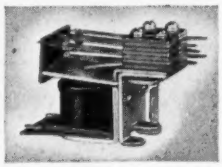

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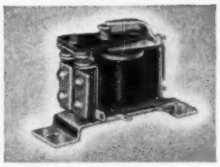

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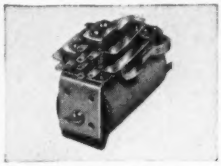

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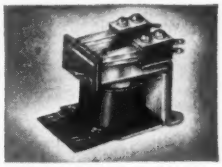

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BOOKS RECEIVED

ACOUSTIC MEASUREMENTS. By Leo L. Beranek. John Wiley & Sons, Inc., New York, 1949, 914 pages, $7.00. Discusses (1) the basic facts underlying nearly every type of acoustic measurement, (2) the details of many types of acoustic measuring apparatus, (3) the advantages and disadvantages of alternate methods for accomplishing electroacoustic measurements, and (4) the theory of many acoustic phenomena.

METAL FINISHING GUIDEBOOK-DIRECTORY, 18th Edition. Finishing Publications, Inc., New York, 1949. 468 pages, $2.00. Reference manual of practical information on electroplating, cleaning, polishing, buffing and related subjects.

DIE OPTIK IN DER FEINMESSTECHNIK. By Kurt Raentsch. Carl Hanser—Verlag, Munchen, Germany, 1949, 317 pages, 27 DM. The book covers optical methods used in precision measurements.

INTRODUCTION TO THEORETICAL AND EXPERIMENTAL OPTICS. By Joseph Valasek. John Wiley & Sons, Inc., New York, 1949, 454 pages, $6.50. Four-part book covering geometrical optics, physical optics, radiation and spectra and experiments relating to each of these fields.

THE STORY OF MAGNESIUM. By W. H. Gross. American Society for Metals, Cleveland, Ohio, 1949, 258 pages, $2.00. Provides the practical man in industry, without professional or technical training, a chance to understand the science of magnesium. The author has achieved a combination of simplicity, accuracy, and readability which, with more than 100 illustrations, makes an excellent reference source for every process including casting, fabrication, machining, joining, surface finishing, riveting and welding of magnesium.

INDUSTRIAL ELECTRONICS. By Harold W. Ranney. Delmar Publishers, Inc., Albany, New York, 1949, 213 pages, $3.25. Written for electricians, technicians, students, instructors and others who wish to learn the fundamentals of vacuum tubes in electric circuit control. Covers the principles of operation of electronic tubes and contains only a few references to the field of communications electronics.

ALTERNATING CURRENT FUNDAMENTALS. By Clarence H. Bensman. Delmar Publishers, Inc., Albany, New York, 1949, 163 pages, $2.75. This book provides the basis for the electrical worker and technician to function intelligently in the factory and power fields. The basic principles of alternating current circuits, the effects of resistance, inductance and capacitance, explanations of voltage-current and power relations, and the use of vector diagrams in single-phase and poly-phase electrical applications are covered.

FACSIMILE. By Charles R. Jones. Murray Hill Books, Inc., New York, 1949, 422 pages, $6.00. Brings together as much as possible of the important information available on facsimile as a communications medium, both for guidance of the user of facsimile equipment and of the technical man. Emphasis has been placed on the devices and their circuits rather than on theory. The operation of available equipment is described in simple terms, and a section on servicing methods is included.

APPLIED EXPERIMENTAL PSYCHOLOGY. By Alphonse Chapanis, Wendell R. Garner and Clifford T. Morgan, John Wiley & Sons, Inc., New York, 1949, 434 pages, $4.50. Shows how the discoveries made by experimental psychologists about how we see, make movements, and hear can be applied in engineering design to produce more efficient machines for human use.

ELECTRONIC TIME MEASUREMENTS. Edited by Britton Chance, Robert I. Hulsizer, Edward F. MacNichol and Frederick C. Williams. McGraw-Hill Book Company, New York, 1949, 538 pages, $7.00. Vol. 20 of Massachusetts Institute of Technology Radiation Laboratory Series. Book opens with a survey of the use of precision timing methods in distance finding with detailed designs of precision ranging circuits depending upon both manual and automatic control. Second part treats electrical circuits using supersonic delay elements for the cancellation of recurrent waveforms as used in moving target indication systems. Third part presents several precision methods for data transmission employing pulse timing techniques.

ENGINEERING OPTICS—The Principles of Optical Methods in Engineering Measurement. By K. J. Habell and Arthur Cox. Pitman Publishing Corp., New York, 1948, 411 pages, $7.50. Authors make a critical survey of the most important optical methods and instruments that are applicable to engineering practice. Two theoretical chapters on the properties of ideal systems are included, and other chapters deal with microscopes, telescopes and other optical instruments, with the effects of light and illumination and with the methods of optical projection.

TV PICTURE PROJECTION AND ENLARGEMENT. By Allan Lytel. John F. Rider Publisher, New York, 1949, 192 pages, $3.30. This book is concerned with the optical systems employed in television receivers, with the greatest emphasis on the projection types. The electric circuits of the receivers are not discussed. This book is offered as an explanation of elementary optics as applied to television receivers. The optical service instructions can be used as laboratory experiments to illustrate the fundamental optical principles involved.

PRINCIPLES OF MAGNAFLUX—Third Edition. By F. B. Doane and C. E. Betz. Magnaflux Corporation, Chicago, 1948, 388 pages, $5.00. An up-to-date source of information on all phases of magnetic particle inspection, including the increasing uses for this inspection in many fields, such as high volume production industries, foundries, railroad, aircraft, and automative overhaul, the refineries and oil fields, etc.

CONSTRUCTIVE USES OF ATOMIC ENERGY. Edited by S. C. Rothmann. Harper & Brothers, New York, 1949, 258 pages, $3.00. Comprises articles by fourteen scientists who are among the leaders in atomic research in many fields. Describes the "Peaceful Atom"—the uses to which it is already being put in such fields as industrial power, chemistry, metallurgy, aviation, ceramics, soil-fertilizer research and biological, pharmaceutical, and medical research.

MAINTENANCE MANUAL OF ELECTRONIC CONTROL. Edited by Robert E. Miller. McGraw-Hill Book Company, New York, 1949, 304 pages, $4.50. Practical installation, maintenance, and service manual for the electrical and electronic technician. Based on a series of articles published in *Electrical Construction and Maintenance* on installation and service of industrial electronic control.

INDENTATION HARDNESS TESTING. By Vincent E. Lysaght. Reinhold Publishing Corporation, New York, 1949, 288 pages, $4.50. Useful, factual and based on up-to-date industrial research practice, this book covers the problems involved in the hardness testing of metals and other materials. It describes the instruments in most common use and evaluates the advantages and disadvantages of each and gives complete specifications. Covers in detail the recent advances in the field and the work of present hardness committees of the leading technical societies.

OUR SUN. By Donald H. Menzel. Blakiston Company, Philadelphia, 1949, 326 pages, $4.50. Explains the basic methods for finding out about the sun. Pictures solar activity and the vast explosions occurring in the sun's atmosphere, and presents the immediate relationship between sun and earth and the sun's influence on our everyday life and work.

MODERN OSCILLOSCOPES AND THEIR USES. By Jacob H. Ruiter, Jr. Murray Hill Books, Inc., New York, 1949, 326 pages, $6.00. Shows what the oscilloscope is, what it does, and how to use this versatile instrument in the field of electronics, in industry, in radio and television receiver servicing, in radio transmitting, in teaching, etc. For the technical reader, the book gives the engineering essentials of oscilloscopes, their tubes, circuits, operation, etc., and gives complete details of the various methods of application.

A.S.M.E. MECHANICAL CATALOG AND DIRECTORY—1950—39th Volume. American Society of Mechanical Engineers, New York, 1949, 300 pages, Distributed to members. Catalogs of industrial products, buying directory and list of trade names.

CHEMICAL ENGINEERING CATALOG—34th Edition 1949-50. Reinhold Publishing Corporation, New York, 1949, price not given. A collected source of condensed and standardized data about equipment, machinery, raw materials, heavy and fine chemicals used in the industries employing chemical processes of manufacture with classified indices of such equipment and materials, carefully cross-referenced.

INGENIEUR-TABELLEN. By Theodore Ricken. Carl Hanser—Verlag, Munchen, Germany, 1949, 292 pages, 9.50 DM. A book of reference tables for engineers.

BEITRAGE ZUR LOTABWEICHUNGSAUSGLEICHUNG UND GEOIDBESTIMMUNG—First Part. Bamberger Verlagshaus Meisenbach & Co., Bamberg, Germany, 1949, 106 pages, 5 DM. The translation of the title is "Contributions to the Adjustment of the Deflections of the Vertical and Determination of the Geoid."

BEITRAGE ZUR ZENTRIERUNG VON RICHTUNGEN. Bamberger Verlagshaus Meisenbach & Co., Bamberg, Germany, 1949, 47 pages, 3 DM. The translation of the title is "Contributions to the Reduction of Directions to Center."

THE V. I. STORY. By David O. Woodbury. National Electrical Manufacturers Association, New York, 1949, 88 pages, $1.00. This book covers the nature and purpose of varnished insulations and their origin and development. Uses of varnished insulations in rotating apparatus, transformers, cable making, electric power distribution, motor controllers, high-tension magnetos and electronic equipment are discussed in detail.

ATOMIC SPECTRA. 2nd Edition (Methuen's Monographs on Physical Subjects). By R. C. Johnson. John Wiley & Sons, Inc., New York, 1950. Cloth, 4¼ x 6¾ inches, 120 pages. $1.25. Due to the important advances made in this field the author has found it necesary to bring out a second edition within four years. Written primarily for the student it gives a compact statement of the latest advances in this field. Includes 38 diagrams.

SPECTROCHEMICAL PROCEDURES. By Charles E. Harvey. Applied Research Laboratories, Glendale, Calif., 1950. Cloth, 6 x 9 inches, 402 pages, $7.50. A guide to scientific workers developing methods of spectrochemical analysis. The subject matter is presented on a non-theoretical basis as far as possible.

ANALYTICAL ABSORPTION SPECTROSCOPY. Edited by M. G. Mellon. John Wiley & Sons, Inc., New York, 1950. Cloth, 6 x 9 inches, 618 pages, $9.00. Explains the problems, methods, and equipment involved in measuring the absorptive capacity of a given sample of radiant energy in the spectral region of 0.2 to 25 microns. Nine authorities on different phases cover the subject.

KENT'S MECHANICAL ENGINEERS HANDBOOK—(2 volumes)—12th Edition. Design and Production Volume by Colin Carmichael. Power Volume by J. Kenneth Salisbury. John Wiley & Sons, New York, 1950. Over 1200 pages each, Leatherette, 5½ x 8½, $8.50 per volume. The presentation of each subject attempts to give the engineer a quick grasp of the essentials of the field, together with pertinent technical data in condensed form consisting essentially of basic principles: working formulas, charts and tables, standard dimensions etc.

AN INTRODUCTION TO EXPERIMENTAL STRESS ANALYSIS. By George Hamor Lee. John Wiley & Sons, New York, 1950. Cloth, 6 x 9 inches, 319 pages, $5.50. This book presents the theory, instrumentation, and basic techniques involved in the most commonly used methods of experimental stress analysis.

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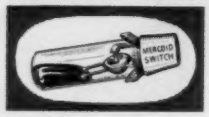

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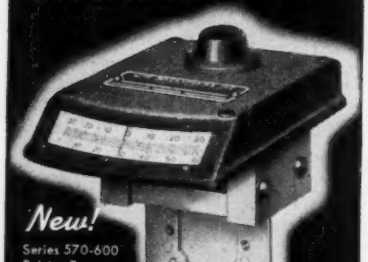

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Manufacturers' New Literature

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S-484 "THE GRAPHIC." 4-page issue (Bulletin 550) of this house organ features article titled "Guiding With Graphics—Electrical Recorders Control Non-electrical Processes."—Esterline-Angus Co., Inc., P.O. Box 596, Indianapolis 6, Ind.

S-485 "THE HYDROMIKE." 4-page No. 33 issue of this house organ features articles titled "Model Study," an hydraulic model study of Mississippi Basin, and "Rivers of Oregon—The Columbia," a pictorial feature.—Leupold & Stevens Instruments, Inc., 4445 N. E. Glisan St., Portland 13, Ore.

S-486 D-C. KILOVOLTMETER. 2-page bulletin illustrates and describes maker's d-c. multirange kilovoltmeter; covers features, characteristics, construction, applications.—Sensitive Research Instrument Corp., 9-11 Elm Ave., Mount Vernon, N. Y.

S-487 ELECTRONIC EQUIPMENT COMPONENTS. 24-page catalog describes and illustrates many of maker's parts and components for electronic equipment (covers over 100 items); includes principal characteristics and gives suggestions for ordering.—General Radio Co., 275 Massachusetts Ave., Cambridge 39, Mass.

S-488 VARIABLE TRANSFORMERS. 4-page folder illustrates and describes maker's newly redesigned "Powerstat Types 116 and 261" variable transformers; covers all "new mechanical and electrical improvements"; gives ratings, dimensions.—The Superior Electric Co., Hannon Ave., Bristol, Conn.

S-489 "THE GENERAL RADIO EXPERIMENTER." 8-page Vol. 25, No. 1 issue of this house organ features article on company anniversary titled "35 Years of Instrument Manufacture," also article titled "A Polariscope for Dynamic Stress Analysis."—General Radio Co., 275 Massachusetts Ave., Cambridge 39, Mass.

S-490 POROUS STAINLESS STEEL FILTERS. 8-page bulletin describes and illustrates maker's "Surfamax" filters with porous stainless steel elements; covers uses, advantages, special features, operation; includes diagrams, tables technical data.—Micro Metallic Corp., 193 Bradford St., Brooklyn, N. Y.

S-491 TRIPLE-PURPOSE GAGE. 12-page bulletin illustrates and describes maker's "King-Gage" hydrostatic instrument which shows directly the weight, volume or depth of liquids in storage or process; covers operation, applications, construction.—King Engineering Corp., Box 300, Ann Arbor, Mich.

S-492 D-C. POWER SUPPLIES. 4-page bulletin describes and illustrates maker's "Varicell" d-c. power supplies for providing stabilized regulated variable d-c. from a-c. lines; covers operation, ratings, dimensions, stabilization and regulation data.—The Superior Electric Co., Hannon Ave., Bristol, Conn.

S-493 "THE BODINE MOTORGRAM." 8-page Vol. 30, No. 3 issue of this house organ features pictorial on applications of maker's motors; also illustrates and describes various types of maker's fractional-hp. motors, covering features and dimensions.—Bodine Electric Co., 2250 W. Ohio St., Chicago 12, Ill.

S-494 "THE LABORATORY." 32-page Vol. 19, No. 5 issue of this house organ features articles titled: "It's the Chemist Who Changes Your Oil," and "Carbon Determinations in Steel Now By Induction Ignitions"; also contains articles on laboratory equipment (balances, vacuum pumps, incubators, stirrers, etc.).—Fisher Scientific Co., 717 Forbes St., Pittsburgh 19, Penna.

S-495 LIQUID LEVEL CONTROLLERS. 8-page Catalog Section I illustrates and describes maker's liquid level controllers; covers features, advantages, operation, types, applications; contains index to maker's Catalog Sections.—Magnetrol Inc., div. of Fred H. Schaub Engineering Co., Inc., 2110 S. Marshall Blvd., Chicago 23, Ill.

S-496 SWITCH MECHANISMS AND HOUSINGS. 12-page Catalog Section II illustrates and describes maker's switch mechanisms and switch housings; covers features, specifications, operating principles on mechanisms, and construction features on housings.—Magnetrol Inc., 2110 S. Marshall Blvd., Chicago 23, Ill.

S-497 BOILER WATER LEVEL CONTROLLERS. 4-page Catalog Section III illustrates and describes maker's boiler water level controllers; covers features, advantages, specifications.—Magnetrol Inc., 2110 S. Marshall Blvd., Chicago 23, Ill.

S-498 TANK FLOAT SWITCHES. 6-page Catalog Section IV describes and illustrates maker's tank float switches with top mounting; covers specifications, features, construction; contains tables of max. insertion depths to actuating level.—Magnetrol Inc., 2110 S. Marshall Blvd., Chicago 23, Ill.

S-499 RECORDING THERMOMETERS. 44-page Bulletin T840 describes and illustrates maker's "Series 500" recording thermometers for temperatures between −125 and 1000 F.; covers ranges, measuring systems, charts, bulbs, typical installations, tubing, chart drives, dimensions, and ordering information.—The Bristol Co., Waterbury 20, Conn.

S-500 "hp JOURNAL." 4-page Vol. 1, No. 10 issue of this house organ features article titled "The Explanation for Certain Cathode-follower Effects"; gives specifications for maker's "Model 451A" bridging amplifier, also illustrates, describes and gives specifications for maker's "Model 712A" regulated power supply.—Hewlett-Packard Co., 395 Page Mill Rd., Palo Alto, Calif.

S-501 SOLDERLESS WIRE TERMINALS CHART. Industrial wall chart (18 by 25 in.) illustrates, describes, and provides simplified selection of maker's solderless wire terminal types; includes application and cost factors, uses, features, and sections on tooling, splices and connectors, automatic machines, and other processes.—Aircraft-Marine Products, Inc., 1568 N. 4th St., Harrisburg, Penna.

S-502 ELECTRIC CLOCK MOVEMENTS. 4-page Catalog 324 describes ad illustrates maker's line of electric clock movements; covers specifications and ratings of each movement, plus details as to setting, mounting, etc.; includes how-to-order information.—Haydon Mfg. Co., Inc., Torrington, Conn.

S-503 "CENCO NEWS CHATS." 52-page No. 68, Summer 1950 edition of this house organ features article on the Technical Association of the Pulp and Paper Industry, an article on William G. MacNaughton, one of original founders of TAPPI, and descriptive items on various laboratory equipments, chemicals, etc.—Central Scientific Co., 1700 Irving Park Rd., Chicago 13, Ill.

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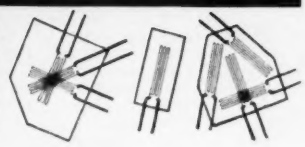

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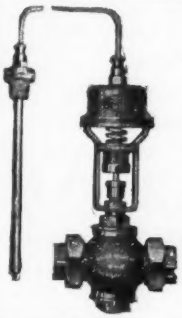

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S-505 AUTOMATIC ENGINE CONTROL EQUIPMENT. 4-page bulletin describes and illustrates maker's automatic engine control equipment (start and stop sets, relays, overspeed governors, solenoids, switches, panels, etc.).—Synchro-Start, 1046 W. Fullerton Ave., Chicago 14, Ill.

S-506 TRANSFORMERS. 16-page Catalog 49A describes and illustrates maker's transformers for instrument and other uses; covers features, specifications, dimensions for various types.—Audio Development Co., 2833 Thirteenth Ave. S., Mineapolis 7, Minn.

S-507 "S-L INSTRUMENT NOTES." 4-page No. 15 issue of this house organ features article titled "Measurement of Colloid Osmotic Pressures with an Unbonded Strain Gage Transducer"; also describes maker's high output transducers. — Statham Laboratories, 9328 Santa Monica Blvd., Beverly Hills, Calif.

S-508 PHOTOGRAPHIC LAMPS. 4-page bulletin pictures and describes maker's open-spiral self-ionizing lamps for photographic lighting; covers features, characteristics and dimensions. —Amglo Corp., 4234 Lincoln Ave., Chicago 18, Ill.

S-509 CHRONO-TACHOMETERS. 20-page Booklet No. 173 illustrates and describes maker's chrono-tachometers, electric tachometers, timers, and laboratory panels for voltage distribution and testing; covers features, specifications.—The Standard Electric Time Co., Springfield 2, Mass.

S-510 RELAYS. 28-page loose-leaf folder contains bulletins illustrating and describing maker's relays (s-p. d-t. relays, temperature compensated voltage relays, multi-circuit and sensitive polarized relays); covers features, specifications, prices, and ordering information.—Sigma Instruments, Inc., 70 Ceylon St., Boston 21, Mass.

S-511 "COOK DIAPHLEX NEWSLETTER." Issues 1 to 10, Vol. 1, and 1 to 3, Vol. 3 of this house organ feature articles on maker's relay switches, aircraft fuel selector switch, minature hermetically-sealed relay, time delays, etc.; covers features, specifications.—Cook Electric Co., 2700 N. Southport Ave., Chicago 14, Ill.

S-512 SPRING BELLOWS. 12-page Catalog No. 50 describes and illustrates maker's line of "Spring-life" bellows; covers features, construction; contains data chart on various models.—Cook Electric Co., 2700 N. Southport Ave., Chicago 14, Ill.

S-513 TIME DELAYS. 8-page Bulletin No. 2 describes and illustrates maker's "Tarrytron" thermal time delays; covers features, test results and circuits, and data sheet.—Cook Electric Co., 2700 N. Southport Ave., Chicago 14, Ill.

S-514 RECORDERS, CONTROLLERS, INDICATORS. 24-page Bulletin W1800 (Specification Index) illustrates and describes maker's recorders, controllers, indicators, and other instruments; covers both instruments and variables concerned.—The Bristol Co., Waterbury 91, Conn.

S-515 THERMOCOUPLES, PYROMETER ACCESSORIES. 56-page "Buyers' Guide and Users' Manual" Bulletin P1238, in two sections describes and illustrates maker's thermocouples and pyrometer accessories. Section 1, the users' manual, covers technical data on pyrometry; section 2, the buyers' guide, covers specific types available with pertinent data.—The Bristol Co., Waterbury 91, Conn.

S-516 COUNTING DEVICES. 124-page General Catalog G-50 illustrates and describes maker's line of counting devices (small square case, hand-operated, high-speed reset, small reset, general purpose, medium size, worm-driven, magnetic, heavy duty, "Elm City" rachet, starwheel, predetermining, and special counters); covers features, specifications of each type and model, also typical installations; contains an "application index," and revised (Jan. 1, 1950) price list.—Veeder-Root, Inc., Hartford 2, Conn.

S-517 ELECTRIC TACHOMETERS. Two 16-page bulletins describe and illustrate maker's "Model 40 and Model 120" electric tachometers; cover features, construction, operation, recommended indicators, summary of indicator characteristics, ordering information; contain drawings showing mounting information and dimensions; show various accessories.—The Electric Tachometer Corp., 2218 Vine St., Philadelphia 3, Penna.

S-518 DATA RECORDER SYSTEM. 8-page Bulletin MR-B1 illustrates and describes maker's multi-channel data recorder system; covers operation features, construction, applications, specifications.—Cook Research Labs., Div. of Cook Electric Co., 1457 Diversey Pkwy., Chicago 14, Ill.

S-519 ELECTRIC THERMOMETERS, INDICATORS. 38-page loose-leaf contains several bulletins describing and illustrating maker's electrical ration resistance thermometers with indicators, electronic temperature control, magnetic and thermal relays, tip- and stem-sensitive resistance bulbs, and sealed thermostats; covers features, principles of operation, specifications. —Instrument Div., Thomas A. Edison, Inc., West Orange, N. J.

S-520 "LANCO APPARATUS NEWS." 4-page Vol. 2, No. 2, issue of this house organ features articles on Burrell wrist-action shaker, burettes, balance, stainless steel beakers and other laboratory supplies.—Arthur S. La Pine & Co., 121 W. Hubbard, Chicago 10, Ill.

S-521 METERING PUMP. 2-page Bulletin 1A-R pictures and describes maker's "No. 6100" metering pump for hot waxes and cements; covers features, applications.—Edward E. Robinson, Inc., 95 Park Ave., Nutley 10, N. J.

S-522 INSULATION TESTER. 4-page Bulletin 4A describes and illustrates maker's "Hypot Junior" multi-purpose electrical insulation tester; covers features, operation and specifications.—Associated Research, Inc., 3758 W. Belmont Ave., Chicago 18, Ill.

S-523 D-C. MILLIVOLTMETER. 2-page bulletin pictures and describes maker's "Model 200-A" d-c. millivoltmeter; covers specifications, features, applications.—Industrial Control Co., 1462 Undercliff Ave., New York 52, N. Y.

S-524 GAGE VALVES. Four 2-page bulletins describe and illustrate maker's liquid level gage valves (No. 64 and 46-U, No. 66-U for flat glass gages, and No. 93-U for heated-cooled gages); covers features, dimensions, applications.—Jerguson Gage & Valve Co., 80 Fellsway, Somerville 45, Mass.

S-525 RADIOACTIVITY MEASUREMENT. 2-page Bulletin A-2 illustrates and describes maker's "Model L-75" analysis unit for measurement of radioactivity; covers features, construction, operation, sensitivity, advantages, other uses, and accessories.—Landsverk Electrometer Co., Pippin Rd., Cincinnati 31, Ohio.

S-526 INSULATION TESTER. 24-page Bulletin 21-20 illustrates and describes maker's "Megger" heavy-duty type insulation and resistance tester; covers uses, ratings; also covers maker's "Megger" ohmmeter and other insulation testers and accessories; gives specifications on all models.—James G. Biddle Co., 1316 Arch St., Philadelphia 7, Penna.

S-527 MICROPARTICLE CLASSIFIER. 2-page bulletin illustrates and describes maker's "No. 6000" centrifugal microparticle classifier; covers uses, features, operations, specifications. —Harry W. Dietert Co., 9330 Roselawn Ave., Detroit 4, Mich.

S-528 "THE C-D CAPACITOR." 16-page Vol.

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15, No. 7 issue of this house organ features article titled "A Wide-band Instrument Amplifier"; also contains regular feature, "The Radio Trading Post—A Free Market-place for Buyers, Sellers, and Swappers.—Cornell-Dubilier Electric Corp., Hamilton Blvd., South Plainfield, N. J.

S-529 SAFETY MASK. 4-page Bulletin B-20 illustrates and describes maker's "Demand Mask" for 30-min. respiratory protection in gases, smoke and fumes; covers features, uses.—Mine Safety Appliances Co., Braddock, Thomas and Meade Sts., Pittsburgh 8, Penna.

S-530 WARBURG "MANOMETRICON." 10-page Bulletin 675 illustrates and describes maker's Warburg "Manometricon" for micro gas reactions, and Dubnoff metabolic shaking incubator; covers features, operation, use of each.—Precision Scientific Co., 3737 W. Cortland St., Chicago 47, Ill.

S-531 ELECTROLYSIS MILLIVOLTMETER. 2-page bulletin pictures and describes maker's "Duplex" electrolysis millivoltmeter for corrosion testing; covers features, ranges, uses.—Sensitive Research Instrument Corp., 9-11 Elm Ave., Mount Vernon, N. Y.

S-532 VIBRATION ISOLATION MOUNTS. 8-page Catalog 502 describes and illustrates maker's air-damped "Barrymounts" for control of shock and vibration in airborne equipment; covers features, advantages, isolation characteristics, sizes, dimensions, and applications.—The Barry Corp., 179 Sidney St., Cambridge 39, Mass.

S-533 AIR PRESSURE REGULATION. 4-page Technical Bulletin 105, "Performance Characteristics," illustrates and describes characteristics of maker's "H-10" manual loading regulator, "H-15" service regulator, and "FH-15" combination reducing valve and filter. Defines basic differences between flowing service and dead end regulation, using charts and other data to support suggested tests.—Conoflow Corp., 2100 Arch St., Philadelphia 3, Penna.

S-534 "THE BODINE MOTORGRAM." Vol. 30, No. 4 issue of this house organ features article titled "Automatic Radioactivity Measurements," also page of hints on "How to Make Fractional-horsepower Motors Last Longer."—Bodine Electric Co., 2250 W. Ohio St., Chicago 12, Ill.

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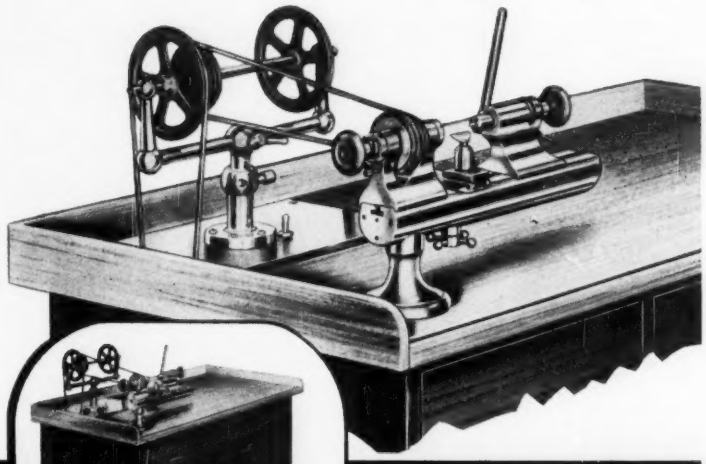

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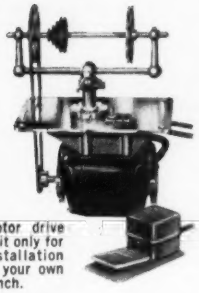

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